No. 8002

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NEW YORK CENTRAL SYSTEM

EXAMINATION FOR FIREMEN OR HELPERS ON OTHER THAN STEAM POWER

FIRST, SECOND AND THIRD SERIES
OF
QUESTIONS AND ANSWERS
AND
EXAMINATION FOR HOSTLER

LOCOMOTIVE OPERATION

EFFECTIVE
JULY 1, 1956

This manual applies on the New York Central Railroad, the Pittsburgh and Lake Erie Railroad, the Indiana Harbor Belt Railroad, the Chicago River and Indiana Railroad, and the Chicago Junction Railway. It takes effect July 1, 1956, superseding all previous instructions or rules.

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EXTREME CAUTION SHOULD BE USED WHEN WORKING AROUND OR HANDLING ELECTRICAL EQUIPMENT

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METHOD OF EXAMINATION

FIREMEN

A. Firemen will be required to pass a written and oral examination on the First, Second and Third Series of Questions under the direction of a Mechanical Examiner at the expiration of 12, 24 and 36 months, respectively, of actual service.

B. It must be understood that those who conduct the examinations may ask any questions bearing on any subject of these examinations in order to determine how well the person being examined understands the subject. A mere memorized answer will not be sufficient. The full meaning of each answer must be understood.

C. When a fireman is employed he will be given a copy of the First, Second and Third Series of Questions and Answers.

D. A man receiving a percentage of less than 80 on a subject in the First or Second Series of Questions may be given an additional trial in not less than 30 nor more than 60 days from date of first examination, unless otherwise covered by agreement, and failing on the second trial, he will be dropped from the service.

E. A man receiving a percentage of less than 80 on a subject in the Third Series of Questions may be given two additional trials, each not less than 60 days apart, unless otherwise covered by agreement, and failing on the third trial, the case will be handled as covered by agreement.

F. A candidate for position of engineman will be required to pass the Third Series of Questions before being used as an engineman.

G. When the answer to a question relates to a rule—reference to the rule number only will not be sufficient.

H. Firemen will be required to be familiar with equipment used in their territory at time of examination.

FIRST SERIES OF QUESTIONS AND ANSWERS

FIRST SERIES

EXAMINATION FOR FIREMEN AND HOSTLERS

1. Q. What is of the first importance in discharge of your duties?

   A. Safety.

2. Q. What are the fireman's duties on arrival at the engine house prior to going out on a locomotive?

   A. Report to engine dispatcher or foreman; consult bulletin board and sign book; compare watch with standard clock and register on prescribed form, also have Diesel Manual or Series Book with you.

3. Q. What are the duties of the fireman after being assigned to the locomotive?

   A. Check log book or work report for any condition that would affect the starting or placing on the line of any oil engines of the locomotive; know that there are necessary supplies such as lube oil, fuel oil, cooling water, steam generator water, where required, flagging equipment tools, fire extinguishers, extra jumper cable; see that all engines are on the line and hand brakes released.

4. Q. What supplies are necessary on a diesel locomotive?

   A. Fire extinguishers, flagging equipment, spare fuses on locomotives where used and necessary tools. Also check sufficient lube and fuel oil and water supplies.

5. Q. What is a diesel electric locomotive?

   A. A diesel electric locomotive consists of one or more units, which contain one or more power plants. Each power plant is made up of a diesel engine which drives a main generator, supplying electricity to the traction motors geared to the axles.

   NOTE: Some units may be coupled in multiple and controlled from one operating cab equipped with necessary controls.

6. Q. What is a diesel engine?

   A. A diesel engine is an internal combustion engine which

burns fuel oil, using the heat of compression for ignition and may be a two stroke cycle or four stroke cycle type.

7. Q. What is meant by two or four stroke cycle engine?
   A. A two stroke cycle engine has a power stroke every revolution of the crankshaft.
   A four stroke cycle engine has a power stroke every other revolution of the crankshaft.
8. Q. What is the purpose of the overspeed trip mechanism?
   A. An overspeed trip mechanism is provided as a safety feature to stop the injection of fuel into the combustion chamber if the engine speed becomes excessive.
9. Q. What is the purpose of the engine governor?
   A. The purpose of the engine governor is to control the speed of the engine at a setting determined by the engineman's throttle.
10. Q. What is known as a power plant?
    A. One diesel engine, main generator, air compressor, one or more auxiliary generator and necessary appurtenances to connect and control. There may be more than one power plant in one unit.
11. Q. What is the purpose of the traction motor blower?
    A. Its purpose is to blow cooling air to the traction motor.
12. Q. What does the cooling system consist of?
    A. The cooling system consists of water pump, radiators, cooling water tank, water level and temperature gauges, filler pipes, necessary piping, drain valves, cooling fans, shutters and thermostatic control switches.
13. Q. What does the lubricating system consist of?
    A. Oil sump in the base of the engine, scavenging oil pump, lubricating oil pump, lube oil strainers, sump oil strainer, lube oil filter, lube oil cooler, necessary piping, gauges and drain valves, pressure regulating valve and low lube oil protective device.

14. Q. How are lubricating oil pumps driven?

A. They are gear driven by the diesel engine.

15. Q. What is the purpose of the lubricating oil pumps on diesel oil engines?

A. The pumps are used to draw lubricating oil from the engine base or sump, to force the oil through the oil filters, oil cooling radiators, and to the diesel engine. The oil is distributed to the diesel engine bearings, wrist pins, valve mechanism, gears, etc. Some diesel oil engines are equipped with more than one lube oil pump.

16. Q. Why is it necessary to cool the oil?

A. So as to afford proper cooling and lubrication effects on bearings, pistons and cylinder liner walls.

17. Q. Where is cooler located?

A. The lubricating oil system and water cooling systems are brought together at a heat exchanger where oil passages adjacent to water passages permit the cooling water to cool the hot oil.

18. Q. What does the fuel system consist of?

A. Fuel supply tank, emergency fuel shut off valve, suction filter, fuel pump, discharge filter, injector lines, injection equipment return lines, pressure gauges, and sight glasses.

19. Q. How can the various pipes through the locomotive be distinguished?

A. By observing the color legend applied or tracing between pieces of equipment.

20. Q. What is the color legend for diesel electric locomotive piping?

A.

RED	Fuel Oil	YELLOW	Lube Oil
GREEN	Air	ORANGE	Steam
LIGHT BLUE	Cold Water	DARK BLUE	Hot Water

21. Q. What is the proper procedure a fireman must follow before starting a diesel oil engine?

A. 1. Make certain that no one is working on or around the locomotive who might be injured.
2. Check fuel oil supply.
3. Check engine cooling water supply.
4. Check lubricating oil supply.
5. Check lubricating oil level of air compressor.
6. Check sand supply.
7. Check governor oil level.
8. See that ground relay knife switch is closed and sealed. (If so equipped).

22. Q. What should be the position of the throttle and reverser lever before attempting to start engine?

A. The throttle must be in idle position. The reverser must be in neutral position.

23. Q. What is the proper procedure to follow to start and place on the line the oil engine of an *Electro-Motive* passenger locomotive?

A. *"A" Units 4000-4035 incl.,* and *"B" Units 4100-4113 incl.:*

1. Close all switches in distribution panel.
2. Start train stop MG set on leading unit.
3. Set up train stop and see that red check light indicates properly.
4. Place automatic brake valve in lap position independent brake valve in full application position.
5. Put throttle in "idle" and see that "PC" switch is not on.
6. Put reverser lever in neutral.
7. Put in control and fuel pump push buttons.
8. Open all cylinder test valves, hold layshaft in shutdown position, push starting button and note any discharge of water or oil in cylinders. If accumulations appear, report to diesel maintenance forces. Close test valves.

9. Turn on fuel pump at engine control panel.
10. Check fuel to see that 5-lb. glass fills up.
11. Isolation switch must be in start position.
12. Check to see that overspeed lever is in reset position.
13. Push lay shaft towards engine until fuel pointer on governor indicates 2 to 3, push starting button and hold until engine fires. If engine does not fire in ten seconds, ascertain cause.
14. When engine starts check lube and piston cooling oil gauges, also ground relay and starting contactors.
15. Keep hold of lay shaft to prevent engine racing and bring to idling speed.

"A" Units 4036-4095 incl.:

1. Close main battery switch (this switch is located to left of hand brake in steam generator compartment).
2. Close all switches on the electrical control cabinet.
3. At engineman's station close control and fuel pump switches.
4. Place independent brake in full application position.
5. Check PC switch.
6. Be sure that the reverse lever is in neutral.
7. Start train stop MG set on leading unit.
8. Set up train stop and see that red check light indicates properly.
9. Check steam generator transfer switch at power panel in No. 2 electrical control cabinet. (This is a large double throw switch and normal position is to the right.)
10. Check engine lube oil and water levels and oil level in governor and air compressor.
11. Isolation switch must be in "start" position.
12. Open all cylinder test valves, hold lay shaft in shut down position, push starting button and note any discharge of water or oil from the cylinders. If ac-

cumulations appear, report to the maintenance forces, close test valve.

13. Turn on fuel pump in engine control panel.
14. Check for fuel flow in sight glass. (Fuel should flow through glass next to engine. If fuel flows through other filter sight glass, report.)
15. Check to see that the overspeed lever is in reset position.
16. Check setting of the governor oil alarm trip button.
17. Hold lay shaft ¼ open.
18. Press the engine start button until engine starts. Note lube oil pressure (should be at least 10 lbs.) (if engine does not fire in ten seconds ascertain cause).
19. Keep hold on lay shaft to prevent engine racing and bring to idle speed.

Q. What is the proper procedure to follow to start and place on the line the oil engine of an *Electro-Motive Combination locomotive?*

A. *"A" Units 3500-3507,* incl., and *"B" Units 3600-3603,* incl.:

In Leading "A" Unit:

1. Close main battery switch.
2. Close all knife switches in distribution panel.
3. Start train stop MG set on leading unit.
4. Set up train stop and see that red check light indicates properly.
5. Place independent brake valve in full application position.
6. Place automatic brake valve in lap, and rotair valve in passenger and open double heading cock slowly.
7. Place throttle in idle, and note that the PC light is not on.
8. Place transition lever in off position.
9. Put reverse lever in neutral.
10. Put in control and fuel pump push button. (What-

ever light buttons are needed may also be placed in.)

11. Open all cylinder test valves. Hold lay shaft lever in shutdown position, and push starting button. Hold button long enough for engine to make several revolutions and check for any indication of water or oil in cylinder. If accumulation appears, report to maintenance point. Close test valves.
12. Be sure fuel pump starts and five-pound glass next to engine fills with clean fuel. If fuel shows in other sight glass, report this to maintenance point.
13. Isolation switch must be in start position.
14. Woodward governor low oil shutdown plunger must be in, and red band around shaft of plunger not visible. No alarm bells or lights should be on.
15. At the engine starting panel in the engine room, snap on fuel pump.
16. Check position of overspeed trip lever, and reset if necessary.
17. Push lay shaft toward engine until fuel pointer on governor indicates 11 to 13 and keep firm hold on lever.
18. Push starting button and hold until engine starts, then release. If engine fails to start in 10 seconds, release button and ascertain cause. Retain hold on lay shaft lever to prevent engine racing, and bring to idle speed. During starting, the alarm bell will ring and starting contactor light will come on. This should stop as soon as starting button is released.

In "B" Units:

1. Repeat item 1 and items 10 to 18, inclusive, above.
2. See that the cutout cock under brake valve and main reservoir cock to brake pipe feed valve are closed.
3. Place control emergency cock on control valve in passenger corresponding to "P" position selected on the rotair valve leading "A" Unit.

In Trailing "A" Unit:

1. Close double heading cock, place rotair valve in passenger lap, place automatic brake in running and remove handle, move independent brake valve to running and remove handle. Place in storage box provided.
2. Place throttle in idle.
3. Place transition lever in off.
4. Place reverse lever in neutral and remove lever.
5. Repeat item 1 and 10 to 18 listed under leading "A" unit.

Q. What is the proper procedure to follow to start and place on the line the oil engine of an *Alco Passenger* locomotive?

A. *"A" Units 4200-4214,* incl., and *"B" Units 4300-4304,* incl.:

1. Close main battery switch.
2. On each unit upon which it is desired to start engine, place all except following circuit breaker in "on" position:
   Auxiliary generator ammeter.
3. At engineman's control station in lead unit see that reverse handle is inserted and in "neutral" position, throttle in "idle" and selector handle in "off" position. Insert brake handles.
4. Set up train stop and air brake equipment on leading unit.
5. See that control circuit breaker and fuel pump or engine run circuit breaker are "on" at engineman's control stand in leading unit.
6. Make certain trailing "A" unit (if present) controls are in following positions:
   a) Selector handle "off" position.
   b) Throttel "idle" position.
   c) Reverser handle "off" position and removed.
   d) After making full service automatic brake ap-

plication, lap the brake valve, close double heading cock.

e) Independent brake valve handle—"release" position and removed.

f) Move automatic brake valve handle to "running" and remove.

g) Move K-2-A rotair valve to "Pass. Lap" or "Frt. Lap" position corresponding to service to be performed.

h) Close the signal line supply cock.

i) Control circuit breaker, generator field switch, train stop generator and fuel pump circuit breakers on the control stand—"off" position.

7. Check engine overspeed trip reset button. This is pressed in to reset.
8. Snap on fuel pump switch on engine control panel and note that fuel pump runs and fuel oil pressure builds up to 30 p.s.i. on gauge on panel.
9. Starting with engine control switch in "off" position, rotate to "idle."
10. Hesitate momentarily; then turn start switch on engine control panel clockwise to crank engine. Hold switch until engine fires and 20-lb. of lube oil pressure shows on gauge, alarm bell will stop and yellow low oil pressure light will go out.
11. If engine does not fire, release start switch and turn engine control switch to "off." Repeat engine starting. Do not attempt to start engine repeatedly as this will run down the batteries.
12. Turn engine control switch one position at a time to "Run" (hesitating in each position).

Q. What is the proper procedure to follow to start and place on the line the oil engine of an *Alco Freight* locomotive?

A. *"A" Units 1000-1123,* incl., and *"B" Units 3300-3372,* incl.:

1. Close battery switch.

2. Close the following circuit breakers located on the control panel:
   a) Cab lights and auxiliaries.
   b) Headlights.
   c) Fuel pump.
   d) Crankcase exhauster.
   e) Blower generator.
   f) Control negative.
   g) Control positive.
   h) Auxiliary generator.
   i) Auxiliary generator field.
   j) MG set.
   k) Blower generator field.
3. Put throttle in "idle."
4. Place selector switch in "OFF."
5. Place reverse handle in "OFF."
6. Be sure turning gear is not engaged.
7. Close the control and fuel pump circuit breakers located on the engineman's control panel.
8. Check engine overspeed trip. This is pushed in to reset.
9. Close the panel light and fuel pump switches located on the engine control panel.
10. Allow fuel oil pressure to build up to 35 or 45 pounds as indicated on fuel oil pressure gauge mounted on engine control panel.
11. Starting with engine control switch in "OFF" turn engine control switch to start position.
12. Hesitate momentarily, then turn engine starting on engine control panel clockwise to crank engine. Hold in this position until engine is firing and 20-lb. lube oil pressure shows on gauge. Alarm bell will stop and yellow low oil pressure light will go out.
13. The engine should start turning promptly when the start switch is turned, and firing should occur within a few revolutions.

Q. What is the proper procedure to follow to start and place on the line the oil engine of a *Fairbanks-Morse Passenger* locomotive?

A. *"A" Units 4400-4405,* incl.:

1. After closing main battery switch, check the engine overspeed reset lever on engine.
2. Snap on fuel pump switch on engine control panel and note that fuel pump runs and fuel oil pressure builds up to between 12 and 18 lbs. on gauge on engine control panel.
3. Starting with engine control switch in "OFF" position, rotate to "IDLE." Hesitate momentarily; then pull out on switch knob to start position.
4. Hold knob in "START" position until engine fires, and lubricating oil pressure low oil pressure alarm light goes out. Pressure will be approximately 8 lbs. The engine should start turning promptly when the engine control switch knob is pulled out and firing should occur within a few revolutions.
5. If engine does not fire, release knob and turn to "OFF" position. Repeat engine start. Do not attempt to start engine repeatedly as this will run down the batteries.
6. Turn engine control switch (one position at a time) to "RUN." It comes under control of the throttle handle as soon as the switch is moved above "idle" position.

FIRST SERIES—EXAMINATION FOR FIREMEN AND HOSTLERS

"A" Units 4500-4507, incl.:

Place switches and circuit breakers as shown below:

	Position On Leading "A" Unit	*Position On Trailing "A" Unit*
1. Main Battery Switch	On	On
2. Throttle Handle	Idle	Idle
3. Selector Handle	Off	Off
4. Reverse Handle	Off	Removed
5. Rotair Valve	Pass.	Pass. Lap.
6. Automatic Brake Valve	Cut In	Cut Out
Engineman's Switch Panel		
7. Control Breaker	On	Off
8. Fuel Pump Breaker	On	Off
9. Generator Field Breaker	On	Off
Cabinet Breaker Panel in Cab		
10. Alternator Field Breaker	On	On
11. Loco. Light Breaker	On	On
12. Heater and Defroster Breaker	On	On
13. Control Cutout Breaker	On	On
14. Train Stop Breaker	On	Off
15. Air Pressure Control (Lbs.)	80	80
16. Battery Ammeter	Charge	Charge
17. Fuel Pump Breaker at Engine Control Panel	On	On
18. Train Stop Switch Rear of Unit "B" Side	On	On
19. Traction Motor Cutout Switch	Normal	Normal
20. Ground Relay Cutout Switch	Sealed On	Sealed On

A. To start and put on line:

1. Check engine overspeed trip and governor low oil shutdown button. Snap "on" fuel pump breaker at engine control panel and note that fuel oil pressure builds up to 25 pounds. To start, place isolation switch to right and upward against spring pressure in start position. Hold until engine fires. The engine should start turning properly and firing should occur within a few revolutions. If the engine fails to fire, release isolator and repeat. If failure again occurs investigate for cause as continued unsuccessful attempts to start will run down batteries.
2. To put engine on line, turn isolation switch down to "run" position.

NOTE: Engine will not deliver power if starting contactors stick closed, as indicated by white warning light on engine control panel. If so, pry them apart with a DRY WOODEN STICK.

Q. What is the proper procedure to follow to start and place on the line the oil engine of an *Electro-Motive Freight* locomotive?

A. *"A" Units 1600-1603,* incl., and *"B" Units 2400-2403,* incl.:

In Leading "A" Unit:

1. Close all knife switches in distribution panel.
2. Start train stop MG set.
3. Set up train stop and see that red check light comes on.
4. Place automatic brake valve in "Lap" and open double heading cock.
5. Place independent brake valve in full application position.
6. Place throttle in "Idle" position, and note "PC" light is not on.
7. Place transition lever in "OFF."
8. Put reverse lever in neutral.

9. Put in "CONTROL" and "FUEL PUMP" push buttons (and whatever light buttons are needed).
10. Open all cylinder test valves, hold layshaft lever in shut down position and push starting button. Hold button long enough for engine to make several revolutions and check for any indication of water or oil in cylinders. If accumulation appears, report to Terminal Foreman. Close test valves.
11. Be sure fuel pump starts and 5-lb. glass fills with clear fuel.
12. Isolation switch must be in "START" position. No alarm bells or lights should be on.
13. At engine starting panel in engine room turn on fuel pump.
14. Check position of overspeed trip lever and reset if necessary.
15. Push layshaft lever toward engine until fuel pointer on governor indicates 2 to 3 and keep firm hold on lever.
16. Push starting button and hold until engine fires, then let go. If engine fails to start in 10 seconds, release button and ascertain cause.
17. Keep hold of layshaft lever to prevent engine racing and bring to idle speed.

In "B" Unit or Units:

1. Repeat items 10 to 17 above.

In Trailing "A" Unit if used.

1. Close double heading cock. Place automatic brake valve in "Running" position and independent brake valve in "Lap" position and pin both handles.
2. Place throttle in "IDLE."
3. Place transition lever in "OFF."
4. Place reverse in "Neutral" and remove lever.
5. Repeat items 10 to 17 above.

Q. What is the proper procedure to follow to start and place on the line the oil engine of an *Electro-Motive Freight* locomotive?

A. *"A" Units 1604-1834,* incl., and *"B" Units 2404-2474,* incl.:

In Leading "A" Unit:

1. Close all knife switches in distribution panel.
2. Start train stop MG set.
3. Set up train stop and see that red check light indicates properly.
4. Place automatic brake valve in "LAP" and "ROTAIR" valve in "P" and open double heading cock.
5. Place independent brake valve in full application position.
6. Place throttle in "IDLE" and note that "PC" light is not on.
7. Place transition lever in "OFF."
8. Put reverser lever in "neutral."
9. Put in "CONTROL" and "FUEL PUMP" push buttons (and whatever light buttons are needed).
10. Open all cylinder test valves, hold lay shaft lever in shut down position and push starting button. Hold button long enough for engine to make several revolutions and check for any indication of water or oil in cylinders. If accumulation appears, report to Terminal Foreman. Close test valves.
11. Be sure fuel pump starts and 5-lb. glass fills with clear fuel.
12. Isolation switch must be in "START" position.
13. Woodward Governor low oil shut-down plunger must be in and red band on plunger not visible. No alarm bells or lights should be on.
14. At engine starting panel in engine room, turn on fuel pump.
15. Check position of overspeed trip lever and reset if necessary.
16. Push lay shaft lever toward engine until "Fuel"

pointer on governor indicates "11" or "13" and keep firm hold on lever.

17. Push starting button and hold until engine fires, then let go. If engine fails to start in 10 seconds, release button and ascertain cause.
18. Retain hold on lay shaft lever to prevent engine racing, and bring to idle speed (fuel pointer at "17").

    During starting, the alarm bell will ring and starting contactor light will come on. This should stop as soon as starting button is released.

In "B" Unit or Units:

1. Repeat items 1 and 10 to 18, inclusive, above.
2. See that the following air cocks are closed:
   Cock under brake valve.
   Main reservoir cock to brake pipe feed valve.
3. Place controlled emergency cock or control valve in "PASS." or "FRT." corresponding to "P" or "F" position selected on leading "A" unit.

In Trailing "A" Unit if used:

1. Close double heading cock, place rotair valve in either "PL" or "FL" corresponding to "P" or "F" position selected on leading unit, move automatic brake valve to "running" and remove handle.
2. Make sure all switches at engineman's position are off.
3. Place throttle in "IDLE."
4. Place transition lever in "OFF."
5. Place reverse lever in "Neutral" and remove lever.
6. Repeat items 1 and 10 to 18 above.

Q. What is the proper procedure to follow to start and place on the line the oil engine of an *Electro-Motive Road Switch* locomotive?

A. *Units 5600-5817,* incl., and *5900-5948,* incl.:

1. Close all switches on distribution panel.
2. Close control and fuel pump switches at engineman's station.

3. Start train stop MG set.
4. Set up train stop and see that red check light indicates properly.
5. Place automatic brake valve in lap position and independent brake valve in full application position.
6. Put throttle in idle.
7. Put reverse lever in neutral.
8. Turn off fuel pump at engine starting panel.
9. Isolation switch must be in start position (handle horizontal).
10. Open all cylinder test valves, push starting button and note any discharge of water or oil from cylinders. If accumulations appear, report to diesel maintenance forces. Close test valve.
11. Check to see that overspeed lever is set.
12. Turn *on* fuel pump at starting panel.
13. Check 5 lbs. sight glass on engine for fuel.
14. Check governor oil alarm trip button.
15. Push starting button, and hold until engine fires. If engine does not fire in ten seconds, ascertain cause.
16. See that starting contactors are not stuck. If so, pry apart with a *DRY WOODEN STICK*. Reset ground relay.
17. Check battery charging ammeter.
18. Place isolation switch in run position (handle vertical).

Q. What is the proper procedure to follow to start and place on the line the oil engine of an *Electro-Motive Switch* locomotive?

A. *Units 567-704,* incl., *8700-9001,* incl., *9600-9630,* incl.:

1. Close main battery switch.
2. Set up train stop equipment and see that red check light indicates properly (if used).
3. Check overspeed.
4. Check to see if low lubricating oil button on governor is in; if so equipped.

5. Place isolation switch in "START" position (if used.)
6. If engine has been shut down for some time, check for accumulation of water and oil with compression relief valves open. Close valves.
7. Place throttle in idle position
8. See that shutdown lever is in run position, if so equipped.
9. Place reverser in neutral position.
10. Press in control button.
11. Press in fuel pump button.
12. See that fuel pressure gauge registers at least 5 lbs. pressure.
13. Press in engine start button and hold until lube oil pressure builds up to 15 lbs. release. (Do not hold start button in more than 10 seconds; if engine does not fire, ascertain cause.)
14. Place isolation switch in "RUN" position (if used).

Q. What is the proper procedure to follow to start and place on the line the oil engine of a *Fairbanks-Morse Freight* locomotive?

A. *"A" Units 5000-5005,* incl., and *"B" Units 5100-5101,* incl.:

1. Close battery switch.
2. Close the following circuit breakers:
   (a) Governor.
   (b) Auxiliary generator voltage regulator.
   (c) Control positive.
   (d) Control negative.
   (e) Auxiliary generator.
   (f) Lighting (as required).
3. Set radiator fan control switch.
4. Put throttle in idle.
5. Put selector handle in "OFF."
6. Put reverser in "NEUTRAL" position.
7. Place control and generator field switch on engineman's control stand in "ON" position.

8. Close fuel pump circuit breaker.
9. Check engine overspeed trip—reset if necessary.
10. Close fuel pump switch on engine control panel.
11. Fuel oil pressure should be from 12 to 18 lbs.
12. Starting with engine control switch in "OFF" position, rotate to "IDLE." Hesitate momentarily, then pull out on switch knob to start position.
13. Hold knob in "START" position until engine fires and low lubricating oil pressure alarm light goes out.
14. If engine does not fire, release knob and turn to "OFF" position. Repeat engine starting. Do not attempt to start engine repeatedly as this will run down the battery.
15. Set up train stop and air brakes.

"A" Units 5006-5017, incl., and *6600-6607,* incl.

"B" Units 5102-5104, incl., and *6900-6903,* incl.

1. Place independent brake in full application position.
2. Start train stop MG set.
3. Set up train stop and see that red light indicates properly.
4. Place isolation switch in isolation position.
5. Place switches, circuit breakers, etc., as shown below:

	Trailing *"A" Unit*	*"B" Unit*	*Leading Unit*
Main Battery Switch	On	On	On
Throttle Handle	Idle	Off	Idle
Selector Handle	Off	—	4
Reverser Handle	Removed	—	Neutral
Rotair Valve	Pass. Lap. or Frt. Lap	—	Frt. or Pass.
Controlled Emergency Cock, D-24 Control **Valve**	—	Pass. or Frt.	—

FIRST SERIES—EXAMINATION FOR FIREMEN AND HOSTLERS

	Trailing "A" Unit	"B" Unit	*Leading* Unit
Automatic Brake Valve	Cut Out	"Release"	Cut in
Hostler's Brake Valve Handle	—	Removed	—
Control Breaker	Off	Off	On
Fuel Pump Breaker	Off	Off	On
Generator Field Breaker	Off	Off	On
Alternator Field Breaker	On	On	On
Locomotive Lights Breaker	On	On	On
Heater and Defroster Breaker	On	—	On
Control Cutout Breaker	On	On	On
Dynamic Brake Breaker (if used)	Off	—	On
Electro-Pneumatic Beam Breaker (if used)	Off	—	On
Train Stop Breaker (if used)	Off	—	On
Control Air Pressure (lbs.)	80	80	80
Battery Ammeter	Charge	Charge	Charge
Traction Motor Cutout Switch	Normal	Normal	Normal
Ground Relay Cutout Switch	Sealed "On"	Sealed "On"	Sealed "On"
Unit Selector Switch	Set for number of units in Loco.	—	Set for number of units in Loco.

6. Check Breakers and switches for correct position in each unit.
7. Snap "On" fuel pump breaker at engineer's breaker panel to be used.
8. Check engine overspeed trip and governor low oil shutdown button.
9. Snap "On" fuel pump breaker at engine control panel and note that oil pressure builds up to 20-25 lbs.
10. Pull isolator to right and turn against spring pressure to "Start" position, and pull to right. Hold until engine fires and lube oil pressure reaches 7 to 9 lbs. The engine should start turning promptly and firing should occur within a few revolutions. If engine fails to fire, release isolator and repeat. If failure again occurs, investigate for cause as continued unsuccessful attempts will run down the batteries.
11. To put engine on line, turn isolator to "Run" position.

Q. What is the proper procedure to follow to start and place on the line the oil engine of a *Fairbanks-Morse Road Switch* Locomotive?

A. *Units 7000-7012,* incl..

1. Close battery switch and fuel pump breaker (Note: This breaker open in trailing unit).
2. At engineman's station close control and fuel pump circuit breakers.
3. Place independent brake in full application position.
4. Be sure that the reverse lever is in neutral.
5. Start train stop MG set.
6. Set up train stop and see that red check light indicates properly.
7. Isolation switch should be in "OFF" position.
8. Check to see that overspeed trip lever is set.
9. Check fuel pressure—must be at least 5 lbs.
10. Press engine start button until engine starts (if

engine does not fire in 10 seconds, ascertain cause).
11. Place isolation switch in "RUN" position.

Q. What is the proper procedure to follow to start and place on the line the oil engine of a *Fairbanks-Morse Freight Transfer* locomotive?

A. *Units 7100-7118,* incl.:

1. Close main battery switch in electrical cabinet. The yellow "low oil" pressure light on the cab bulkhead will light.
2. Close both traction motor cutout switches in electrical cabinet.
3. Close control switch on control panel.
4. Close auxiliary fuel pump switch (turn arrow to right) and wait for fuel pressure gauge to register 15 to 20 lbs.
5. Place locomotive run switch in "OFF" position.
6. Place isolation switch in isolated position.
7. Press down on start button. Hold down until engine starts and continue to hold down until lube oil pressure builds up and indicator light goes off. (If engine fails to start after ten seconds, release button and ascertain cause).
8. Turn off auxiliary fuel pump switch after engine is running.
9. Place isolation switches in "Power" position.
10. Place run switch in run position.

Q. What is the proper procedure to follow to start and place on the line the oil engine of a *Fairbanks-Morse Switch* locomotive?

A. *Units 9100-9137,* incl.:

1. Close battery switch in electrical control cabinet.
2. Place isolation switch in start position (Units 9111-9120, incl.).
3. Place throttle in "Idle" or "Neutral" position.
4. Close control switch or circuit breaker.
5. Close fuel pump switch, wait until 15 to 20 lbs.

appears on the fuel pressure gauge.
6. Place locomotive run switch in "OFF" position.
7. Press in start button, and hold in until engine fires. (If engine does not fire in ten seconds, ascertain cause). Release button.
8. On Units 9104-9109, incl., after engine is running, place fuel pump switch in "OFF" position.
9. Place isolation switch in "RUN" position (Units 9111-9120, incl.).

Q. What is the proper procedure to follow to start and place on the line the oil engine of an *Alco Road Switch* locomotive?

A. *Units 8100-8113,* incl.:

1. Place automatic brake valve in "Lap" position (lead unit). Place independent brake valve in full application position (lead unit).
2. Throttle must be in idle position (all units).
3. Reverse handle must be in neutral position (all units).
4. Check air compressor cutout valve. Must be open (all units).
5. Place brake pipe cutout cock in No. 2 position (trailing unit).
6. Close control switch (first unit only).
7. Start train stop MG set (first unit only).
8. Set up train stop and see that red check light indicates properly.
9. Check position of overspeed trip (all units) .
10. Close battery switch (all units).
11. Close fuel pump switch (first unit only).
12. Wait until fuel pressure builds up to 40 lbs.
13. The following must be repeated on all units:
    (a) Close and hold in engine start switch.
    (b) Wait until lube oil pressure builds up to 25 to 30 lbs.
    (c) Release engine start switch.

FIRST SERIES—EXAMINATION FOR FIREMEN AND HOSTLERS

Units 8200-8375, incl.:

1. Close battery switch.
2. On each unit where it is desired to start engine, close the following circuit breakers located on the control cabinet panel:
   (a) Cab lights and auxiliaries.
   (b) Head light (if needed).
   (c) Steam generator positive (if used).
   (d) Steam generator negative (if used).
   (e) Fuel pump.
   (f) Crankcase exhauster.
   (g) Control negative.
   (h) Control positive.
   (i) Auxiliary generator.
   (j) Auxiliary generator field.
   (k) MG Set.
   (l) Start train stop MG set (first unit only).
   (m) Set up train stop and see that red check light indicates properly.
3. On lead unit put throttle in "idle," selector switch in "OFF," reverse handle in "OFF." Insert brake handles.
4. Make certain that trailing unit controls (if present) are as follows:
   (a) Throttle must be in idle, reverser in neutral and transition selector switch in "OFF."
   (b) Make a full service automatic brake application and lap automatic brake valve and remove handle.
   (c) Move double heading cock tor trailing position.
   (d) Place independent brake valve in release and remove handle.
   (e) Snap "OFF" control circuit breaker, generator field switch, train stop MG set and fuel pump circuit breaker at engineman's control stand.
5. Be sure turning gear is not engaged.

6. Close the control and fuel pump circuit breakers located on the engineman's control panel.
7. Check engine overspeed trip. This is pushed in to *Reset.*
8. Close the panel light and fuel pump switches located on the engine control panel. Allow fuel oil pressure to build up to 35 to 45 pounds as indicated on fuel oil pressure gauge mounted on engine control panel.
9. Starting with engine control in "OFF" turn engine control to "START" position.
10. Hesitate momentarily, then turn engine starting switch on engine control panel clockwise to crank engine. Hold in this position until engine is firing and 20 lbs. lube oil pressure shows on the gauge. Alarm bell should stop and yellow low oil pressure light should go out.
11. If engine does not fire, release start switch and turn engine control switch to "OFF." Repeat engine starting. Do not attempt to start engine repeatedly as this will run down the batteries.
12. Move engine control switch a notch at a time pausing a few seconds at each notch to "RUN" position.

Q. What is the proper procedure to follow to start and place on the line the oil engine of an *Alco Switch* locomotive?

A. *Units 800-916,* incl., *950-957,* incl., *8500-8667,* incl.:

1. Close main battery switch.
2. Set up train stop and see that red check light indicates properly, (if used).
3. Place isolation switch in "Start" position (if used).
4. Make sure throttle is in "Idle" position.
5. Make sure controller is in neutral position.
6. Press in control button.
7. Press in fuel pump button.
8. Make sure fuel oil pressure builds up to 40 lbs. or more.

9. Press in engine start button and hold until lube oil pressure builds up to 20-25 lbs. (If engine does not start in 10 seconds, ascertain cause).
10. Place isolation switch in "Run" position (if used).
11. Check governor switch (if used).

Q. What is the proper procedure to follow to start and place on the line the oil engine of a *Baldwin Freight* locomotive?

A. *"A" Units 3800-3821,* incl., and *"B" Units 3700-3709,* incl.:

1. Close battery switch in the electrical control cabinet.
2. At engineman's station close control switch.
3. Place independent brake in full application position.
4. Check engine shut-down switch, should be open.
5. Be sure that reverser is in neutral and throttle in "OFF" position.
6. Start train stop MG set.
7. Set up train stop and see that red check light indicates properly.
8. Place auxiliary generator switch in "OFF" position.
9. Place fan switch in "Auto" position.
10. Isolation switch must be isolated.
11. Turn on fuel pump on engine control panel.
12. Check for 20 lbs. fuel oil pressure.
13. Check to see that the overspeed trip lever is set.
14. Check setting of the governor oil alarm trip button, when equipped.
15. Press the engine start button until the engine starts and 20 lbs lube oil pressure shows on gauge. (If engine does not fire in ten seconds, ascertain cause.)

— After engine is started —

16. Place isolation switch in "ON" position.
17. Close auxiliary generator switch and note ammeter shows charge.

Q. What is the proper procedure to follow to start and place on the line the oil engine of a *Baldwin Road Switch* Locomotive?

A. *Units 7300-7301*, incl.

1. Close all switches necessary on the electrical control stand, and the battery switch.
2. At engineman's station close control and fuel pump switches. Close M.U. switch in "S" position, if lead, or M.U. if trailing unit.
3. Place independent brake in full application position.
4. Be sure that reverse lever is in neutral.
5. Start train stop MG set.
6. Set up train stop and see that red check light indicates properly.
7. Check to see that overspeed trip lever is in reset position.
8. Press the engine start button until engine starts (if engine does not start in ten seconds, ascertain cause) and hold start button until 20 lbs. lube oil pressure shows on gauge.

Q. What is the proper procedure to follow to start and place on the line the oil engine of a *Lima-Hamilton Road Switch* locomotive?

A. *Units 6200-6215*, incl.

1. Close battery switch.
2. Start train stop MG set.
3. Set up train stop and see that red check light functions properly.
4. Place automatic brake valve in "LAP" and independent brake valve in full application.
5. Check to see that overspeed lever is set.
6. Close M.U. circuit breaker.
7. Place isolation switch in "IDLE" position.
8. Close control and fuel pump switches.
9. Place throttle in "IDLE" position.
10. Place reverser in neutral position.
11. Press engine start button on gauge panel.

12. After engine fires, release button.
13. Close excitation button.

Q. What is the proper procedure to follow to start and place on the line the oil engine of a *Baldwin-Lima-Hamilton Road Switch* locomotive?

A. *Units 6220-6236,* incl.

1. Close battery switch and M.U. breakers in the electrical control cabinet.
2. At engineman's station close control, fuel pump, control auxiliaries and ground relay breaker.
3. Place independent brake in full application position.
4. Be sure that the reverser lever is removed from the control stand.
5. Start train stop MG set.
6. Set up train stop and see that red check light indicates properly.
7. Isolation switch must be in isolated position.
8. Check fuel pressure at gauge on engineman's control stand. (Should be 20-30 lbs., if less, report).
9. Check to see that overspeed trip lever is set.
10. Check setting of the governor oil alarm trip button.
11. Press the engine start button until engine starts. (If engine does not fire in ten seconds, ascertain cause).
12. Place isolation switch in "RUN" position.

Q. What is the proper procedure to follow to start and place on the line the oil engine of a *Baldwin Switch* locomotive?

A. *Units 750-761,* incl., *9300-9307,* incl.:

1. Close main battery switch.
2. Make sure that throttle is in "IDLE" position.
3. Make sure reverser is in "Neutral" position.
4. Turn control switch button to "ON" position. See that fuel pressure gauges register at least 25 lbs. pressure.
5. Press in engine start button and hold until engine

fires and lubricating oil pressure builds up to 20 lbs. (If engine does not start in ten seconds, ascertain cause).

6. After engine is running and all pressures are satisfactory, close exciter field switch and see that battery ammeter indicates charge.

Q. What is the proper procedure to follow to start and place on the line the oil engine of a *Lima-Hamilton Switch* locomotive?

A. *Units 8400-8411*, incl.:

1. Close battery switch in electrical control cabinet.
2. At engineman's station close fuel pump and control switches.
3. Place reverse handle in "NEUTRAL" position.
4. Place throttle in "IDLE" position.
5. Check setting of overspeed trip lever.
6. Check setting of governor oil alarm trip button.
7. Press engine start button and hold until 20 lbs. appears on lube oil pressure gauge. (If engine does not fire in ten seconds, ascertain cause).
8. After engine fires, release start button and close excitation switch.

Units 9800-9820, incl.:

1. Close battery, switch in the electrical control cabinet.
2. At engineman's station, close control and fuel pump switches.
3. Place independent brake handle in full application position.
4. Place reverse lever in neutral and place throttle in idle.
5. Check to see that overspeed lever is set.
6. Check setting of governor oil alarm trip button.
7. Press engine start button until engine starts and 20 lbs. appears on the lube oil gauge. (If engine does not fire in ten seconds, ascertain cause).

8. After engine fires, release start button and close "excitation" switch.

Q. What is the proper procedure to follow to start and place on the line the oil engine of a *Baldwin-Lima-Hamilton Switch* locomotive?

A. *Units 9308-9328*, incl.:

1. Close battery switch in the electrical control cabinet.
2. At engineman's station, close control switch.
3. Place independent brake valve handle in full application position.
4. Place reverse lever in neutral.
5. Check to see that the overspeed lever is set.
6. Check setting of governor oil alarm trip button.
7. Check for 20 lbs. fuel oil pressure on gauge.
8. Press engine start button until engine starts and 20 lbs. appears on the lube oil pressure gauge. (If engine does not fire in ten seconds, ascertain cause).
9. After engine fires, release button and close "auxiliary generator" switch.

24. Q. What final observation should be made after diesel engine has been started?

A. Check lubricating oil pressure, starting contactors, isolation switch in run position, also battery charging ammeter.

25. Q. What are the proper control air pressures?

A. Between 80 and 90 p.s.i.

26. Q. What is the purpose of the control air pressure?

A. It's purpose is to position power contactors, reversers and cam switches in the high voltage system by means of electro-pneumatic valves. In some units it provides air pressure to operate the governor and throttle.

27. Q. What is the purpose of the ground relay?

A. A device to protect the high voltage wiring in event of a ground.

28. Q. What precaution and preparation is necessary prior to moving a diesel locomotive?

A. 1. Make certain that the main air reservoir pressure is up to the required pressure.
2. Check the control air pressure.
3. See that air brake equipment is properly set in all units.
4. Test operation of horns, bells, and sanders.
5. Make visual inspection of exterior and interior of locomotive for:
   (a) Liquid leaking from locomotives.
   (b) Loose parts.
   (c) Proper positioning of shutoff valves.
   (d) Obstruction or blocking under the wheels.
6. Release hand brakes.
7. Make necessary air brake test.
8. Close all switches or circuit breakers not already closed but required before locomotive will run.

29. Q. How would you proceed to move a light locomotive?

A. 1. Place transition in No. 1 position, put reverse lever in forward or reverse, as desired.
2. Blow whistle and ring bell.
3. Release brakes.
4. Open throttle gradually.

30. Q. What attention should be given battery charging equipment?

A. Periodical visual observation of auxilliary generator ammeters as conditions permit on all power plants. A battery charging ammeter should show a charging rate, never discharge.

31. Q. What different types of diesel electric locomotives are in service on the New York Central System?

A. Alco, Baldwin-Lima-Hamilton, EMD, FM, Ingersoll-Rand. These are used in all classes of service—Passenger, Freight and Yard.

32. Q. What protective devices may be found on Diesel Electric Locomotive for protection of equipment.

A. Wheel slip and slide devices.
PC switch or power off light.
Low lube oil pressure switch.
Ground relay.
Alternator failure device.
Hot engine alarm.
Overspeed trip.
Surge relay.
Load meter and dynamic brake warning light.
Emergency fuel cut off valve.
Lube oil high suction switch.
Emergency stop button.
Fuses and circuit breakers.
Fire extinguisher.

33. Q. If ground relay (or surge relay, if so equipped) trips, is reset, and trips again when engine is placed on the line, how many times should it be reset?

A. Three times. If ground relay trips repeatedly, there is a ground in high voltage system and severe damage will result if attempt is made to operate it in this condition. Ground relay or surge relay cut out switch must *not* be opened. Engine should be isolated and tagged and must not be returned to the line until inspected and repaired by maintenance forces.

34. Q. What are the principal electrical systems on a locomotive?

A. The main generator high voltage system, which provides power for moving the locomotive, the auxiliary generator low voltage system, which provides lights, battery charging, fuel pump and control circuits, and in some cases the alternator, for supplying current for operation of traction motor blowers and engine cooling fans.

35. Q. On locomotives equipped with starting fuse, can the oil engine be cranked if the fuse is defective?

A. No. When so equipped this fuse is in the circuit between the battery and the main generator. A defective fuse will not permit the battery to furnish current to the generator for cranking the oil engine.

36. Q. How should an oil engine be taken off the line?

A. Alco Road Switch	8200-8357
Alco Freight	1000-1123, 3300-3372
Alco Pasenger	4200-4214, 4300-4304
F. M. Road Switch	7000-7012
F. M. Transfer	7100-7118
F. M. Freight	5000-5017, 5100-5104
F. M. Passenger	4400-4405, 4500-4507
Baldwin Road Switch	6200-6215, 6220-6236
Baldwin Freight	3700-3709, 3800-3821

A. An engine can be removed from the line by placing the isolation or control switch in idle position.

1. Baldwin Road Switchers 7300-7301:
   An engine can be removed from the line by stopping the train and disconnecting jumpers. After jumper is disconnected, stop engine in normal manner.
2. Baldwin Road Freight 3700-3709, incl., 3800-3821, incl., Fairbanks-Morse Freight 5000-5017, incl., 6600-6607, incl., 6900-6903, incl.:
   An engine can be removed from the line at any time by placing the isolation switch in idle position. If it is desired to stop the engine, hold in stop button and place fuel pump and auxiliary generator switch in off position.
3. Fairbanks-Morse Freight Transfer 7100-7118, incl.:
   (a) Reduce engine speed to idle by means of the throttle.
   (b) Place isolation switch in start position.
   (c) If desired to stop engine, open locomotive

RUN and control switch. Push engine stop button and hold in until engine stops.

4. Electro-Motive Road Switch 5600-5817, incl., 5900-5948, incl.:
   An engine in a unit may be removed from the line by placing isolation switch in start position, after placing throttle in idle. Hold in stop button and shut off fuel pump if it is desired to stop the engine.
5. Electro-Motive Freight 1600-1834, incl., 2400-2474, incl.:
   Electro-Motive Passenger 3500-3507, incl., 3600-3603, incl., 4000-4095, incl., 4100-4113, incl.:
   (a) Reduce engine speed by pulling on lay shaft lever until engine is running at idle speed.
   (b) Place isolation switch in start.
   (c) If desired to stop engine push stop button at engine starting panel and hold until engine stops. Or pull lay shaft lever until engine stops. Shut off fuel pump.

37. Q. Is it permissible to block in low oil protective switch?
    A. Positively No.

38. Q. Is it permissible to block in any electrical relays or contacts?
    A. No.

39. Q. What damage might occur if engineman applied power while locomotive was moving in reverse direction with reverser in forward position?
    A. Equipment might be seriously damaged. Reverser must *always* remain in direction locomotive is moving until locomotive is stopped. In case of emergency follow instructions as outlined in rule 205-A.

40. Q. To what level should cooling water system be filled with engine running?
    A. *EMD*—To "G" valve level or to 1 inch of top of glass.

ALCO—To within 1 inch of the top of the water glass or to top pet cock.

Baldwin — To within 1 inch of the top of the water glass or to top pet cock.

FM—(Without high and low level tanks) to within 1 inch of the top of the water glass or to top pet cock.

FM—(With high and low level tanks.) Summer operation—to within one inch to top of water glass on top tank. Winter operation—to top of water glass on lower tank.

41. Q. On locomotives so equipped, why is it necessary to turn fuel oil and lubricating oil strainers or filters?

A. They should be turned at the start of each tour of duty and as often as necessary to prevent clogging.

42. Q. How would you reset the ground relay on an EMD locomotive?

A. Place throttle in idle and reset ground relay by pushing reset button; or, if operating conditions do not permit above procedure, isolate the engine and reset the ground relay by pushing the reset button, then return engine to line.

43. Q. How would you reset the ground relay on an Alco Road or Road Switch, FM or Baldwin locomotive?

A. Isolate engine, push in ground relay button, then return engine to line.

44. Q. How would you reset the ground relay on a Baldwin-Lima-Hamilton locomotive? (9800-9820, incl.) and 8406-8411, incl.) and (6200-6215, incl.)

A. Place throttle in idle and reverser in neutral. Pull *out* ground relay button, then push *in*. Ground indicating lamp should go out and bell stop ringing.

45. Q. How would you reset the ground relay on an Alco Switch locomotive?

A. Close the throttle, return ground relay to reset position.

46. Q. How would you reset the overspeed trip on an EMD locomotive?

A. Reset overspeed trip by pulling overspeed trip lever counter-clockwise until latched in reset position. Restart engine and return to line in usual manner.

47. Q. How would you reset the overspeed trip on an Alco Road or Road Switch locomotive? 1500 HP. Class.

A. Reset the overspeed trip by pushing reset button in. Restart engine and return to line in usual manner.

48. Q. How would you reset the overspeed trip on a Fairbanks-Morse locomotive?

A. Pull down overspeed lever as far as possible until it latches, then allow lever to return to upright position by itself. Restart engine and return to line in usual manner.

49. Q. How would you reset the overspeed trip on a Baldwin locomotive?

A. Insert the lever in the overspeed housing and push downward. Restart engine and return to line in usual manner.

50. Q. How would you reset the overspeed trip on a Baldwin-Lima-Hamilton locomotive?

A. Remove reset wrench from bracket on the overspeed housing and place same on the indicating pin stud. Move the stud and pin with wrench to the run position. Replace wrench to bracket. Restart engine and return to line in usual manner.

51. Q. How would you reset the overspeed trip on an Alco switch locomotive?

A. Pull out reset handle and reset each cylinder placing cut out pin to its proper position. Restart engine as usual.

52. Q. How would you reset the emergency fuel cut off valve?

A. This is a spring loaded valve and must be reset by hand. Raise valve stem and push yoke into place. On EMD-

E8 and Road Switchers, it is reset by a push rod.

53. Q. What are the duties of a fireman on arrival at terminal after completion of trip?

A. Apply hand brake when required. See that difficulties and unusual defects are noted in log book. Close all windows and doors. Register off duty, calling attention of engineman to any defects.

Headlight

54. Q. From what source does headlight derive its current?

A. From auxiliary generator and battery.

55. Q. What would dim lights indicate?

A. That auxiliary generator is not functioning properly or battery is low. Condition should be reported.

56. Q. What different types of headlight bulbs are commonly in use?

A. Screw type, Pre-focused and Sealed Beam type bulbs.

57. Q. Can bulbs from these different type lights be changed enroute and how?

A. Yes, as follows:

The screw type by opening glass and screwing out defective bulb from socket.

The pre-focused with bayonet base by either opening glass or, in nose of unit by opening plate and turning reflector back, removing old bulb by pressing in then turning to left. In inserting new bulb, make sure it is properly locked in place.

The sealed beam by either opening glass, or, in nose of unit, by removing plate and insert new bulb and tighten screws.

HANDS SHOULD BE PROTECTED AGAINST POSSIBLE INJURY FROM BROKEN GLASS AND CURRENT TURNED OFF.

58. Q. How many bulbs are in a Sealed-Beam headlight?
A. There are two.

59. Q. Is it necessary to have both bulbs burning to have a light?
A. No. Either bulb will burn if not defective, but the use of two is preferred.

60. Q. What is a circuit?
A. The continuous path of current flowing from positive to negative side of generator or battery.

61. Q. How do you change operating cabs?
A. CHANGING OPERATING CABS — 24 RL EQUIPMENT:

NEW TRAILING CAB:

1. Selector handle must be in OFF position, throttle in IDLE and reverser handle moved to OFF and removed.
2. Make a 20 pound automatic brake application, return the brake valve to lap, close the double heading cock, and remove brake valve handles.
3. Move the K-2-A Rotair valve to proper lap position.
4. Snap OFF control circuit breaker, generator field switch, train stop generator and fuel pump circuit breaker on the control stand.

NOTE: If it is desired to keep engines running, just before completing Item 4 above, arrange to have the fuel pump circuit breaker at the engineman's control station of the new leading cab snapped "ON." Never operate with more than one of the fuel pump circuit breakers at the engineman's control stand "ON" except for a few seconds when changing ends. Close all windows and doors and wind breakers.

NEW LEADING CAB:

1. Close generator field, fuel pump and control circuit breakers at engineman's control stand.
2. Start train stop generator and reset train stop system.
3. Place Rotair valve in proper Passenger or Freight position as required.
4. Apply independent brake valve handle and move to full application position.
5. Insert automatic brake valve handle.
6. Open double heading cock slowly.
7. Insert reverser handle.
8. Make air brake test.
9. Locomotive is now ready to move.

FIRST SERIES

MECHANICAL

The Relative Values of Answers in Per Cent

Question	Value	Question	Value	Question	Value
1	1	22	1	43	2
2	1	23	5	44	2
3	2	24	1	45	2
4	1	25	1	46	2
5	1	26	2	47	2
6	1	27	1	48	2
7	1	28	2	49	2
8	1	29	2	50	2
9	2	30	2	51	2
10	2	31	1	52	2
11	1	32	2	53	1
12	2	33	2	54	1
13	2	34	2	55	1
14	1	35	1	56	1
15	2	36	1	57	2
16	1	37	2	58	1
17	1	38	2	59	1
18	2	39	2	60	1
19	1	40	2	61	4
20	1	41	2		
21	2	42	2	TOTAL	100

FIRST SERIES — STEAM GENERATOR

1. Q. What method is used to furnish steam heat for a train?
   A. By means of an automatically controlled, oil fired, forced circulating water tube steam generator. Two types are used, Vapor Clarkson and Elesco.
2. Q. What are the instructions for operating Vapor Clarkson steam generators?
   A. NOTE: Cross handle valves must be opened, round handle valves must be closed before starting.

   Before Starting: (BE SURE DIESEL ENGINE IS RUNNING)

   1. Check to see that the following valves are open: Water suction stop valve, coil shut off valve, water by-pass regulator shut off valve; return water outlet valve at steam separator when used and atomizing air admission valve. Also valves in steam lines to water by-pass regulator and to steam guage.
   2. The following valves should be closed: Steam stop valve, washout solution admission valve, washout solution return valve, manual water by-pass valve, coil blow down valve, water pump test valve, and all drain valves in the line between the water pump and the water tank. Type "OK" generators, only lay-over connection shut off valve and steam admission valve to radiation (open in cold weather).
   3. See that reset button on control panel is "IN."
   4. See that stack switch reset button is "IN" and that high temperature steam reset button is "IN."
3. Q. How should steam generator be started?
   A. 1. Open separator blow-down valve (foot operated) for about one minute to drain steam separator; then reclose valve.
      2. Open fill test valve at separator.
      3. Close main switch.
      4. Turn control switch to "Fill" position (Motor will start and fill the steam generator with water).

5. As soon as water discharges from the "Fill" test valve, turn control switch to "OFF" position, close "Fill" test valve, wait a few moments until the motor stops, then turn control switch to "Run." Burner should start at once. Separator blowdown valve should be latched open until steam pressure reaches 50 lbs.
6. Depress latching lever on train shut off valve, to open the valve to admit steam to the train line, then open manual train line valve slowly.
7. Set water by-pass regulator to required steam train line pressure. Where two or more steam generators are used, the water by-pass regulators on all steam generators should be set the same.
8. Open the foot operated separator blow-down valve two or three times for 3 to 5 second intervals, to drain separator during the first few minutes of operation.

4. Q. How would you fill steam generator with water?

   A. It may take 5 to 10 minutes time to fill the steam generator with water, if entirely empty. *Do not start the steam generator unless the coil has been filled with water.* It may take several minutes time to build up required steam train line pressure.

5. Q. What check must be made after starting steam generator?

   A. Check the atomizing air pressure as indicated on gauge. This pressure should be:

Atomizing Air

30 to 80 lbs. ABDRK — 4516 —30-35 lbs.

" — 4530
OK — 4625 —70-75 lbs.
OK — 4740

Manifold Fuel Pressure at High Fire
145-160

6. Q. If motor fails to start, or fire does not light, what should be done?

   A. If fire fails to start within 10 seconds, look through peep sight glass at top of steam generator to see if there is sparking at the spark plug electrodes. Also check that Servo fuel control moves to firing position and fuel pressure shows on gauge.

7. Q. What is the operating principle of Elesco Steam Generator?

   A. The generator operates on the forced re-circulation principle. The generator consists of a radiant or combustion chamber section and a convection section. The heating surface of the radiant section consists of three elements, the convection portion consists of 4 or 5 elements, forming the envelope of the combustion chamber. Each element is connected to the inlet and outlet headers. Each of the elements is equipped with an orifice at the inlet to insure even distribution of the circulating water.

8. Q. What does motor operate?

   A. The electric motor which drives the hot water circulating pump also drives the fuel pump and blower.

9. Q. How does feedwater pump operate?

   A. The feedwater pump is of the reciprocating type and is steam operated. The steam supply valve is actuated by a float located in the steam separator. A rise in the water level reduces the regulating valve opening and retards the speed of the feed pump and a reduction in water level effects the reverse.

10. Q. How should steam generator be started?

    A. Before starting:

       1. Auxiliary generator on locomotive should be running and main reservoir air pressure should be at least 60 lbs.
       2. Check position of all valves, valves with cross

handles should be fully open. Valves with round handles should be closed.

3. Turn handle on fuel oil filter one full turn.
4. Close main switch by moving handle to "ON" position.

To Start:

If no water shows in the glass, run feed water pump on air as follows:

a. Close pump steam valve.
b. Open pump air valve.
c. Open steam separator air vent cock while filling.
d. When water reaches top of water glass, place toggle switch in "Start" position. Push "Start" button and motor will run.
e. Continue to operate feed water pump on air until water remains in water glass, then shut pump air valve and open pump steam valve.
f. Close steam separator vent valve.
g. Place control switch in running position. Steam generator should fire.
h. As steam generator comes up to pressure, water will tend to rise, use manual or foot pedal blowdown valve to maintain water level in glass.

11. Q. How should steam be fed to the train line?

A. Steam generator pressure should be 275 lbs. shown on pressure gauge, "red hand," before proceeding.

Set lever of steam flow control valve in position 2.

Loosen wing lock nut on steam pressure reducing valve and adjust this valve to give the desired reducing valve setting.

After reducing valve is set, tighten wing lock nut, make certain that manual by-pass valve is tightly closed.

For high train line steam demands during cold weather, move lever of steam flow control valve very slowly to position 4.

When train line is fully charged, train line pressure will

be about reducing valve pressure. These pressures show on steam gauge.

Open remote control steam shut off solenoid valve by pulling lever down to latched position.

Slowly open train line shut off valve to full open position. If necessary use manual blow-down valve to maintain water level in glass.

12. Q. How should steam generators be paralleled or balanced?
    A. Set steam flow control valve levers in same position. Adjust reducing valve to have same pressure. (White hand on steam gauge).

All Steam Generators

13. Q. What running attention should be given steam generator?
    A. Press remote control solenoid blow-down valve, 5 seconds every half hour by means of separator blow-down button on remote control panel in cab.

    NOTE: Toggle switch must be closed on remote control panel.

14. Q. Is it permissible to operate steam generator if all engines in the unit are stopped.
    A. No.
15. Q. Why?
    A. The current that drives the steam generator operating motor normally comes from the auxiliary generator circuit. With this circuit dead because engines and auxiliary generator are not operating, the source of supply for the generator motor would be from the battery which would be drained quickly if we attempted to operate under these conditions.
16. Q. What should be the position of the stop valves before starting steam generator?
    A. They must be closed; to prevent injury to anyone who would be in the vicinity of steam heat connector.

17. Q. How is an Elesco steam generator placed on automatic standby control?

Operating Instructions

A. 1. START STEAM GENERATOR IN USUAL MANNER WITH THE STANDBY SELECTOR SWITCH IN THE "OFF" POSITION AND BRING STEAM GENERATOR UP TO FULL OPERATING STEAM PRESSURE.

2. WITH THE CONTROL SWITCH IN "RUNNING POSITION" TURN THE STANDBY SELECTOR SWITCH TO THE "ON" POSITION. (With standby switch "ON" the burner cycles on when the steam pressure falls to 100 lbs. and cycles "OFF" when steam pressure reaches 295 lbs. The steam generator motor runs at full speed when burner is on and at reduced speed when burner is off.)

3. OPEN THE STANDBY CONTROL HEATER VALVE WIDE. (When heating of steam generator supply water tank is not required this valve need not be opened.)

NOTE: If feedwater suction temperature falls below 40 degrees F., the alarm temperature switch will sound the steam generator alarm. To determine whether alarm is due to a steam generator shutdown or due to low water temperature, push "STOP" button, and if alarm continues to sound it indicates the alarm is sounding due to low water temperature.

When a road switcher is operating in freight service with the steam generator in standby operation, the train line end valves of the locomotive are open and no steam is fed to the train line. In the event of failure of either the tank water heating temperature switch or the tank water heating solenoid valve, the steam generator alarm would sound when the tank water temperature falls to 40 degrees F. If a failure of this type occurred it would

be necessary to close the end valves on the locomotive, operate the steam generator with the standby selector switch in the "OFF" position, open the train line steam shut-off valve to carry steam pressure on the train line, and open the steam generator water supply tank heater valve which obtains its supply of steam from the train line.

18. Q. How is an OK-4740 series Vapor-Clarkson steam generator placed on automatic standby control?

Standby Operation

A. 1. Follow normal FILL and START procedures.
2. Set water by-pass regulator—111 for maximum pressure.
3. Close stop and check valve—15
4. Open return line valve (stanby)—56 and make sure steam admission valve to radiation-10 is open.
5. Turn control switch-102 to STANDBY.

19. Q. How is an ADH-4915 series Vapor Clarkson Watchman Heater placed on automatic standby control?

A. 1. WARNING: Do not start burner unless heater and system are completely filled with coolant liquid. Make sure Fuel shut-off valve (suction line) is fully open at all times.
2. See that main switch is in the "ON" position. Depress the "START" button. This begins the operating sequence of the control circuit. Fuel is admitted to the fire pot where it is ignited by the constant electrical spark.

NOTE: If the engine coolant temperature is above 150°F. the fire will not light because the immersion thermostat contacts are open. In this event depress the HEATER TEST button, which over-rides the thermostat and completes the circuit through the fuel solenoid to fire up the unit. The fire will cycle "off" after the HEATER TEST button is released.

FIRST SERIES

STEAM GENERATOR

The Relative Values of Answers in Per Cent

Question	Value	Question	Value	Question	Value
1	2	8	3	15	5
2	3	9	4	16	4
3	4	10	10	17A	5
4	5	11	10	B	5
5	5	12	5	C	5
6	2	13	5	18	3
7	3	14	10	19	2
				TOTAL	100

FIRST SERIES — AIR BRAKES

1. Q. What is an air brake?
   A. A power brake operated by compressed air to control train speed.

2. Q. What is the purpose of an air compressor?
   A. To supply compressed air for air brake system and all auxiliary air-operated devices.

3. Q. What are the essential parts of air brake system?
   A. Air compressor, main reservoir, compressor governor, air gauges, brake valves, feed and reducing valves, distributing or control valves, E3 or N-1A application valve, brake cylinders, relay valve, cutout cocks, various valves associated piping depending upon type of brake equipment.

4. Q. What is the purpose of main reservoir?
   A. To collect moisture and store a large volume of air for air brake system and auxiliary devices.

5. Q. What types of brake equipment are used on diesel locomotives?
   A. 14-EL, 6-DS, 6-BL, 6-SL, 8-EL, D-22-L, 24-RL.

6. Q. What are the standard air pressures?
   A. Air pressure regulating devices on locomotives must be adjusted for the pressures as indicated in Rule 1512 of "Rules For the Operation and Supervision of Air Brake, Train Air Signal and Steam Heat Equipment, Locomotives and Cars."

7. Q. What pressures are shown on air gauges?
   A. One gauge shows equalizing reservoir and main reservoir, other gauge shows brake pipe and brake cylinder pressures.

8. Q. What is the function of controlled emergency?
   A. With controlled emergency cock in "F" position or Rotair valve in either "FRT" or "FRT. LAP" position,

in an emergency brake application, the development of locomotive brake cylinder pressure is controlled, or delayed, for purpose of allowing adjustment of train slack before locomotive brake applies to maximum pressure.

9. Q. Where is the controlled emergency cock located on 8-EL brake equipment and how positioned?

A. On right side of independent brake valve, positioned in "P" position for light or passenger and "F" for freight.

10. Q. Where is the controlled emergency cock located on 24-RL equipment and how must it be positioned?

A. On the "B" units the controlled emergency cock is located on the control valve and must be positioned in "P" position for passenger or light movement, and "F" for freight only when coupled to a train.

On the "A" units the Rotair valve functions to position the controlled emergency feature and no cut-out cock is needed on the control valve.

11. Q. What is the function of a rotair valve (24-RL equipment)?

A. The rotair valve combines in one valve certain operations which would otherwise require several independent cut-out cocks.

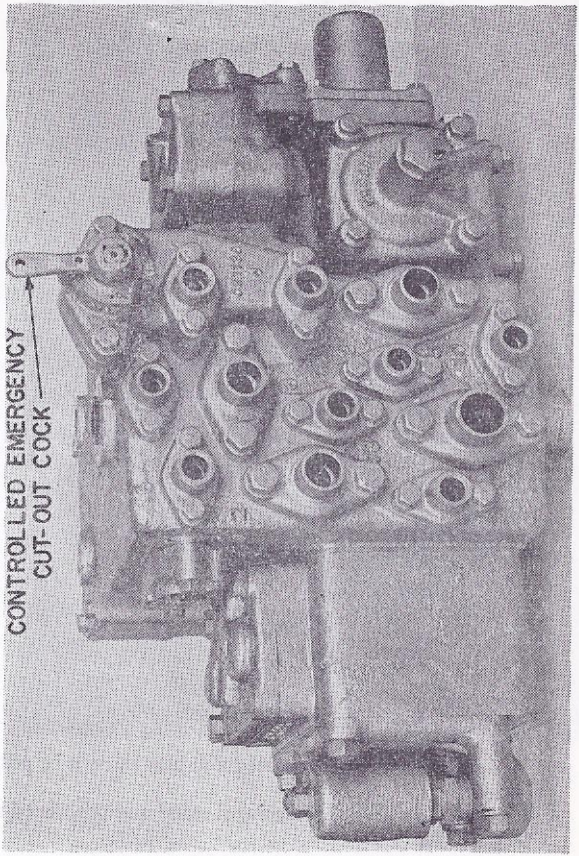
The rotair valve accomplishes the following functions in the four handle positions:

"FRT"—The independent brake valve and the controlled emergency features are both cut in and operative.

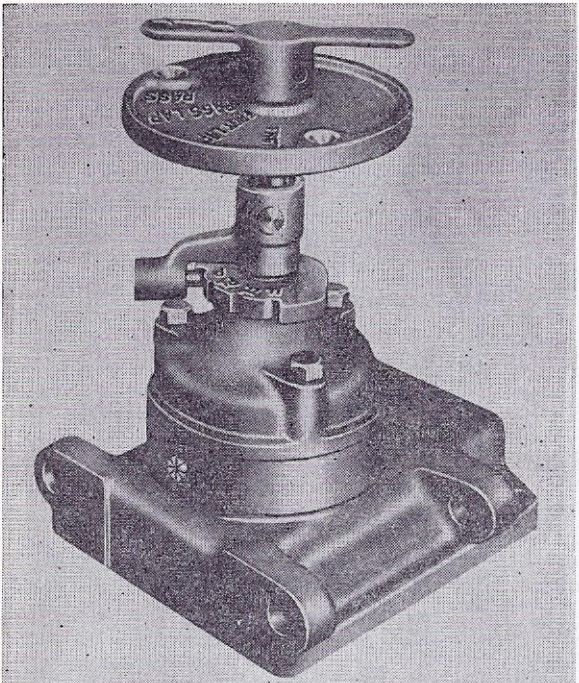
"FRT. LAP"—The independent brake is cut out but the controlled emergency feature is retained and operative.

"PASS. LAP"—Both the independent brake and the controlled emergency feature are cut out.

"PASS."—The independent brake is cut in but the controlled emergency feature is cut out or annulled.



D-24 Control Valve—"B" Unit



K-2-A Rotair Valve

12. Q. Where is Rotair valve located and how must it be positioned?

A. Located near Engineer's control stand and positioned as follows:

Passenger or Light

Place Rotair valve in leading cab in "PASS" position. Trailing "A" unit must be in "PASS. LAP" position.

Freight

Place Rotair valve in leading cab in "FRT" position. Trailing "A" unit must be in "FRT. LAP" position.

13. Q. What position should Rotair valve be in when moving engine around engine terminal or yard?
    A. In "PASS." position.
14. Q. If Rotair valve was left in lap on leading or single unit, would you have independent brake?
    A. No.
15. Q. How should the brakes be left on engine unattended?
    A. Hand brake and independent brake applied, automatic brake in running position, and block wheels when necessary.
16. Q. Why must air brakes system be kept free from leaks?
    A. So air brakes will operate properly and to avoid wasteful work of air compressor.
17. Q. From where is air supply taken for the operation of sander, bell ringer, air whistle, control air pressure, independent brake and other air operated devices?
    A. Main reservoir.
18. Q. How is air compressor driven?
    A. Off main crank shaft of diesel engine or by electric motors.
19. Q. How is automatic brake applied and released?
    A. Applied by reducing brake pipe pressure and released by restoring brake pipe pressure.
20. Q. Name the handle positions of automatic brake valve?
    A. 6-BL, 6-SL, 14-EL—Release, Running, (Holding—not used), Lap, Service, Emergency.

    6-DS—Running, (Holding—not used), Lap, Service, Emergency.

    8-EL, 24-RL—Release, running, (First Service—not used—same as Lap), Lap, Service, Emergency.

    D-22-L—Release, (First Service—not used—same as Lap), Lap, Service, Emergency.

21. Q. How often must moisture be drained from main and sump reservoirs?

A. All moisture must be drained from main and sump reservoirs when taking charge of locomotive for each trip or day's work, before leaving engine terminal, ready track or fueling station, and more frequently, if necessary.

22. Q. When must brake pipe and air signal hose be blown out?

A. Before leaving engine terminal, ready track or fueling station, with care taken to avoid injury or causing undesired emergency brake application.

23. Q. Name the positions of the three-position double heading cock?

A. Lead-Trail-Dead, or #1, #2, #3.

24. Q. How would you position three-position double heading cock for 2, 3, or 4 unit locomotive?

A. Lead or #1 on the leading unit and trail or #2 on all other units.

25. Q. What position should the three position double heading cock be in when double heading two-two unit diesel locomotives with two crews?

A.

Crew	Crew
Lead or #1—Trail or #2.	Dead or #3—Trail or #2.

26. Q. How must locomotive be moved in engine house territory and yard?

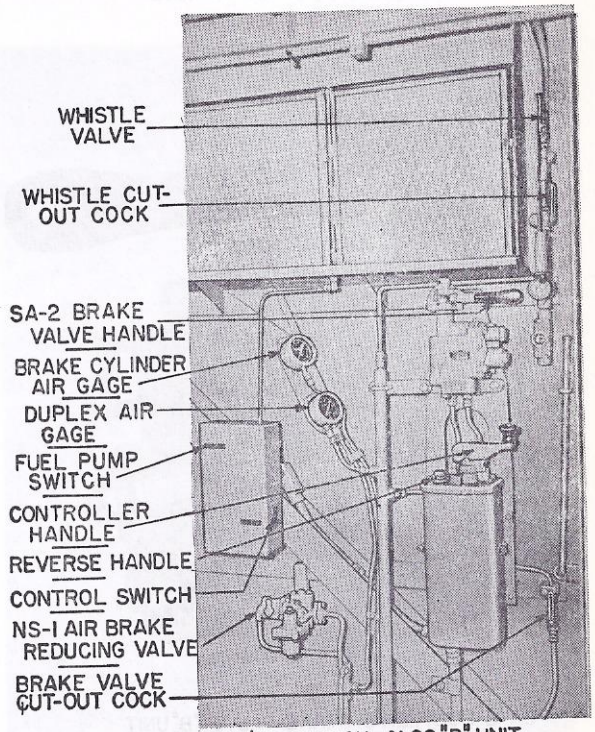
A. Locomotive must be moved safely and not in excess of a speed that would prevent stopping short of any obstruction without sliding wheels of locomotive.

27. Q. What is the purpose of feed or reducing valve for Hostler's control stand on "B" units?

A. This feed valve charges the brake pipe, auxiliary and emergency reservoirs in order that unit may be moved by itself, under control of the hostler. The feed valve cut out cock for hostler's control stand must be kept closed at all times except when the "B" unit is being moved under control of the hostler.

28. Q. Where is the hostler's brake valve located on the "B" unit?

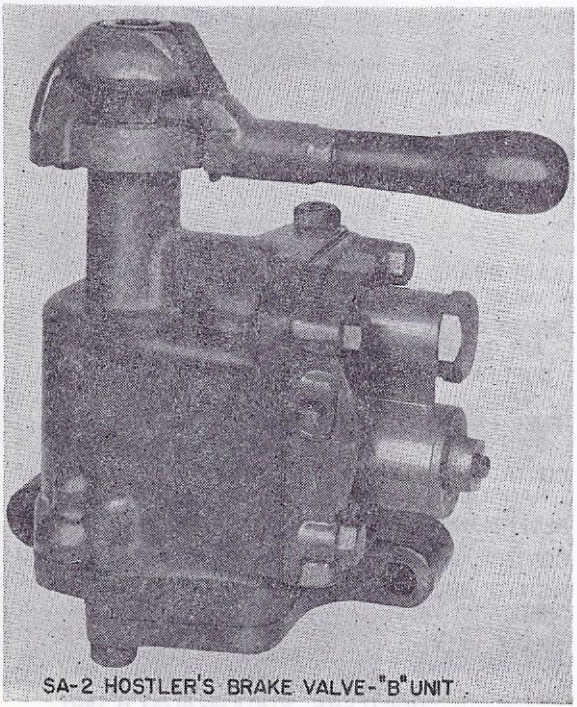
A. At hostler's control stand, closely associated with brake pipe, brake cylinder gauge, feed valve and feed valve cut-out cock.



HOSTLER'S STATION-ALCO "B" UNIT

29. Q. Why is the hostler's brake valve necessary?

A. To operate the brakes on "B" unit. For necessary movements when "B" unit is detached from "A" unit. The hostler's brake valve cut-out cock should be closed and sealed at all times except when "B" unit is being moved independently of the "A" unit.



SA-2 HOSTLER'S BRAKE VALVE-"B" UNIT

30. Q. What is the purpose of the conductor's valve?

A. To permit an emergency brake application if needed, since the hostler's brake valve does not have an emergency feature (or position).

31. Q. What is the purpose of the compressor governor?

A. Used to regulate air compressor so that main reservoir pressure can be maintained within specified limits.

32. Q. What is the purpose of automatic and independent brake valves?

A. Automatic brake valve is used to apply and release the brakes on locomotive and train. The independent brake is used to apply and release the brake on locomotive only.

33. Q. Name handle positions of independent brake valve used with 14-EL and 8-EL brake equipment.

A. Quick release, release, lap, slow application and quick application.

34. Q. Name handle positions of self-lapping independent brake valve used with 6-DS, 6-BL, 6-SL, D-22-L and 24-RL brake equipment.

A. Release and application zone.

35. Q. What is the purpose of emergency relay valve?

A. To insure emergency action of brakes when automatic brake valve handle is moved to emergency position and double heading cock is closed or when train stop application is in effect.

36. Q. What is the purpose of the brake pipe?

A. To convey air to and from the automatic train brake system when the brakes are charged, applied and released.

37. Q. What is the purpose of the brake cylinder?

A. To transmit force to the brake shoes by means of moving piston connected to rods and levers.

38. Q. What does line on end of cock plug or handle indicate, regardless of position of handle?

A. Opening through valve.

39. Q. What gauge hand should be observed in making a service application of brakes?

A. Equalizing reservoir hand.

40. Q. Where does brake cylinder air come from with independent or automatic brake applications?

A. From main reservoir.

41. Q. What action must be taken to provide main reservoir air pressure when locomotive is handled DEAD in train, or when handled in train with air compressors inoperative?

A. Dead engine device cap or cut-out cock must be placed in DEAD engine or open position.

42. Q. What must be done to minimize sliding of wheels?

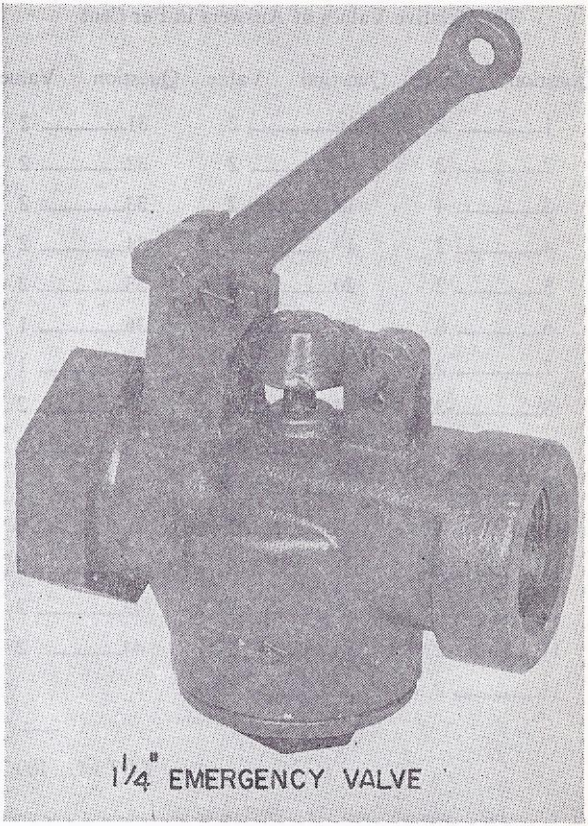
A. Avoid high brake cylinder pressure at low speed.

43. Q. When double-heading, from which locomotive should automatic brakes be controlled?

A. Brakes must be operated from leading locomotive; automatic brake valve on other locomotive must be cut out.

44. Q. In case of emergency, what means is available for applying the brakes other than with the brake valve?

A. Large capacity emergency valves have been provided at standardized locations for maximum safety.


1¼" EMERGENCY VALVE

FIRST SERIES

AIR BRAKES

The Relative Values of Answers in Per Cent

Question	Value	Question	Value	Question	Value
1	2	16	2	31	2
2	2	17	2	32	2
3	4	18	2	33	2
4	2	19	2	34	2
5	2	20	4	35	2
6	8	21	2	36	1
7	3	22	2	37	1
8	3	23	2	38	2
9	2	24	3	39	2
10	2	25	3	40	1
11	3	26	2	41	2
12	2	27	2	42	2
13	2	28	2	43	2
14	2	29	2	44	2
15	2	30	2		

TOTAL 100

FIRST SERIES — AUTOMATIC TRAIN STOP
GRS — US&S

All questions and answers pertain to both US&S and GRS unless otherwise specified.

1. Q. What is the intermittent inductive automatic train stop?
   A. A device for automatically stopping a train.
2. Q. What are the principal parts of the automatic train stop system?
   A. Wayside inductor, receiver on locomotive application valve, cut out cock, doubleheading cock, motor generator, forestalling lever, reset device, forestalling whistle, gong, air compressor and electro-pneumatic valve. US&S also has forestalling reservoir and circuit controller and reset circuit controller.
3. Q. When will the automatic train stop apply brakes?
   A. When engineman does not forestall at signal giving indication at which forestalling is permitted.
4. Q. What provides current for operation of automatic train stop?
   A. Motor generator set.
5. Q. Where is receiver located?
   A. Right side of locomotive, on leading truck. On locomotives equipped for operation in either direction, a receiver is also located on left side.
6. Q. Where is application valve located?
   A. In the service application portion of automatic brake valve on RL-24 equipment. Road switchers with No. 6 equipment in the N-1A application valve, in the engine room with D-22 equipment, on brake valve pedestal of 8-EL equipment.
7. Q. Where is forestalling device located?
   A. In cab, right side.
8. Q Where is forestalling whistle or gong located?
   A. In the cab.

9. Q. Where is reset device located?

A. Under cab, right side.

10. Q. Where is electro-pneumatic valve located?

A. In the nose of cab, steam generator compartment, or engine room depending on class of locomotive.

11. Q. Where is double-heading cock located?

A. 24-RL equipment—Lower left side of brake valve pedestal.

8-EL equipment—Left side of application valve portion on top of brake valve pedestal.

D-22-L equipment—In engine room.

EMD-6-SL equipment—On N-1A application valve under cab floor, left side.

6-SL, 6-BL, 14-EL—On N-1A application valve in cab of all units so equipped; under automatic brake valve on units not equipped.

6-DS equipment—On brake valve pedestal when not equipped with N-1A valve.

12. Q. What valves must be cut in and sealed in order that train stop be operative? Where are they located?

A. Cut-out cocks to EP and EP Whistle valves, located adjacent to these valves or on bulkhead inside nose compartment. Handles on application valves, on brake valve pedestals of 24-RL and 8-EL. On D-22-L equipment, in engine room, and on No. 6 equipment on N-1A brake application valve.

13. Q. Where is main switch located? (U.S.&S. only)

A. In nose or steam generator compartment, depending on class of locomotive.
G.R.S. has two switches.

14. Q. After an automatic train stop brake application and

train has stopped, what must be done to restore device to operating condition?

A. (US&S) Place throttle in idle position and automatic brake valve in lap position, place handle of reset switch and cock in reset position for about four seconds and return to running position. Wait for automatic train stop check light and PC light to go out. Brakes can be released in the usual manner.

(GRS) with brake valve in lap position, throttle in idle, reset button for two seconds. Wait for application valve to reset and PC or power off light to go out and release brakes in usual manner.

15. Q. Is emergency position of automatic brake valve available at all times to manually apply brakes?

A. Yes.

16. Q. How is the territory designated in which automatic train stop system is in use?

A. By timetable, special instruction, bulletin order, and signs at limits of automatic train stop territory.

17. Q. Where are inductors located?

A. At the outside of right hand track rail approximately 80 ft. in rear of signal.

18. Q. What is the purpose of red check light?

A. It indicates train stop application has been received.

19. Q. Do the "Rules for Enginemen and Firemen for the Operation of Intermittent Inductive Automatic Train Stop" supersede or dispense with observance of rules contained in the "Rules for Government of the Operating Department," "Rules for the Operation and Supervision of Air Brake, Train Air Signal and Steam Heat Equipment, Locomotives and Cars," "Timetable Special Instructions" or "Bulletin Orders"?

A. No.

AUTOMATIC TRAIN STOP

The Relative Values of Answers in Per Cent

Question	Value	Question	Value	Question	Value
1	4	8	5	15	6
2	5	9	4	16	8
3	4	10	4	17	6
4	4	11	4	18	5
5	4	12	5	19	5
6	4	13	8		
7	5	14	10		
				TOTAL	100

FIRST SERIES — RAIL DIESEL CARS
AIR BRAKES

1. Q. Is the method of braking used on RDC cars the same as on other types of motive power?
   A. No. On RDC cars braking is accomplished by forcing the brake shoes against both sides of discs which are securely fastened to inside of wheels.

2. Q. Name the principal parts of the air brake system.
   A. The air compressor which is belt diven by an electric motor. Two automatic brake valves, one at each operating station. Feed valve, N-1A brake application valve, D-22-AR control valve, reservoirs, brake cylinders and the necessary piping, gauges and fittings.

3. Q. Will air compressor operate independently if diesel engines are shut down?
   A. No. One or both diesel engines must be running to have air compressor operative.

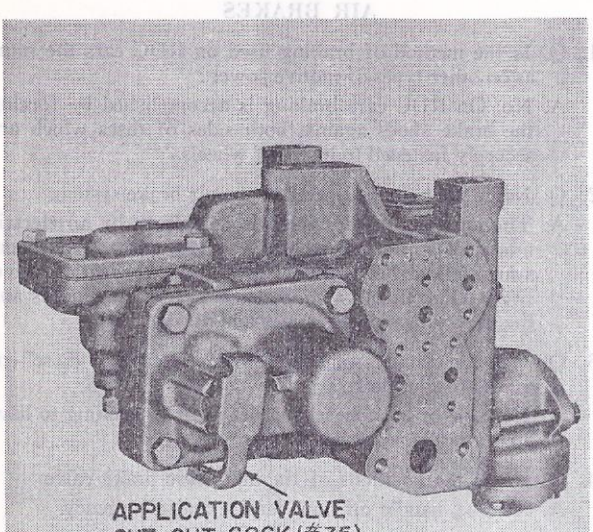
4. Q. Name the positions of the automatic brake valve.
   A. Release, handle off, lap, service and emergency.

5. Q. What are the required main reservoir and brake pipe pressures?
   A. Main reservoir—140 lbs. Brake pipe—90 lbs.

6. Q. Where is the N-1A application valve and double heading cock located?
   A. Inside car, under the seat at partition and valve should be in the "IN" position for single or leading car operation.

7. Q. Where is the train stop cut-out cock?
   A. Mounted on the N-1A application valve application portion.

8. Q. How would you proceed to move Budd car?
   A. Be sure you have required air pressures before releasing of hand brake. Make 25-lb. brake pipe reduction to insure 35-lb. brake cylinder pressure which nullifies



N-1-A BRAKE APPLICATION VALVE

safety pedal, release hand brake. Place reverser in forward or reverse as desired, move throttle to No. 1 and wait until you feel the transmission clutches engage, then place foot on safety pedal, release brakes and then car will accelerate.

AUTOMATIC TRAIN STOP

1. Q. What are the essential parts added to the GRS Intermittent Automatic Train Stop equipment as applied to the Rail Diesel Cars, compared to the single end operated locomotives of other design?

   A. An automatic receiver selector and two receivers and two forestalling devices for double end operation.

2. Q. Where are the receivers located?
   A. At each operating end on right side on the #2 journal box of the leading truck.
3. Q. Where are the forestalling devices located?
   A. Conveniently located directly under the controller box at the operation stations at the ends of the car.
4. Q. What provisions are made for setting up the train stop for operation?
   A. A circuit breaker which must be in "ON" position located in the regulator locker. Also the cut-out cock on the N-1A application valve portion must be cut in and sealed. This is located in control valve compartment under a seat near the middle of the car.
5. Q. Where is the Electro-Pneumatic (EP) valve located?
   A. In center of car, underneath seat and adjacent to the N-1A application valve.
6. Q. Where is the forestalling whistle or gongs located?
   A. At the operating station at each end of the car.
7. Q. How many resetting devices are included on this equipment?
   A. Only one resetting device, which is located at the "B" end of the car, outside, to the right of the vestibule steps.
8. Q. What action must be taken to recover from an automatic train stop application?
   A. Lap brake valve, when car has come to a stop, press reset contact, or button, for not less than two seconds, then release brakes.

RDC Cars

1. Q. What precautions are necessary before starting engines?
   A. See that hand brake is set inside of car.
   See that throttle and reverse levers are removed on the non-operation end of car; on operation end of car, in-

sert master plug and reverser, throttle in off position.

Set isolation switches in normal position in electric cabinet both ends of car.

On the operating end of car, doubleheading cock cut in; on the opposite end cut out.

Inserted master plug switch starts air compressor when engine or engines are running.

2. Q. What should be inspected outside underneath car?

   A. Observe water level—try cocks on end of water tank, both engines, water level should be between upper two try cocks with engine stopped. Check crankcase and transmission oil level in both engines with engines shut down, have filled if required. Also fuel supply and also emergency fuel valve. Close battery switch if equipped.

3. Q. How is engine started?

   A. On engines equipped with neutral and run buttons on engine control panel press NEUTRAL button. Open automatic air shutdown valve by pulling black handle out and away from engine, noting pronounced click as valve opens. Press START button until engine fires. If engine does not start in 30 seconds, check for cause. After engine starts press RUN button when equipped as soon as lubricating oil pressure is normal.

   On engines with only START and STOP buttons on engine control panel, pull automatic air shutdown valve reset lever down and hold. Press START button until engine fires. If engine does not start in 30 seconds, check for cause. Release reset lever when lubricating oil pressure is over 20 p.s.i.

4. Q. What should you look for when engine will not crank?

   A. Make sure that neutral button is pressed on engine control panel. Make sure that automatic air shutdown valve is reset, pull handle or chain noting pronounced click as valve resets. Make sure that isolation switches in both electric cabinets are in normal position. Also check main battery switch when equipped.

5. Q. What should you look for when engine will crank but will not fire?

   A. See if fuel tank is empty. Observe emergency fuel valve for being tripped. Make inspection of engine air intake filter for water or being clogged, or high oil level. Engine may have to be primed—this can be done by pressing crank and stop buttons together.

6. Q. What are the reasons if engine will fire but stops when run button is pressed to run or reset lever released, when so equipped?

   A. By pressing run button before engine crankcase lubrication oil pressure is at normal pressure. Engine water temperature is too high, over 180 degrees. Transmission oil temperature is too high. Faulty protective switches.

FIRST SERIES

RAIL DIESEL CARS

The Relative Values of Answers in Per Cent

Question	Value	Question	Value	Question	Value
RDC CARS		*AIR BRAKES*		*A.T.S.*	
1	5	1	4	1	4
2	3	2	5	2	[illegible]
3	10	3	4	3	[illegible]
4	5	4	4	4	[illegible]
5	5	5	5	5	[illegible]
6	10	6	3	6	3
		7	5	7	3
		8	5	8	4
					TOTAL 100

QUESTIONS AND ANSWERS PECULIAR TO NO. 14-EL. BRAKE EQUIPMENT ELECTRIC LOCOMOTIVES (NEW YORK ELECTRIC TERRITORY) FIRST SERIES

1. Q. What is of the first importance in discharge of your duties?
   A. Safety.
2. Q. What is an air brake?
   A. A brake operated by compressed air to control train speed.
3. Q. What air brake equipment is used on electric locomotives?
   A. 14-EL Brake equipment. It is the adaptation to an electric locomotive of the No. 6 ET brake equipment.
4. Q. What does the 14-EL brake equipment consist of?
   A. An automatic brake valve and independent brake valve combined in one bracket, distributing valve, transfer valve, governor, vent valve and air gauges.
5. Q. Name and explain the purpose of the different positions of the K-14 brake valve: (A) AUTOMATIC PORTION, (B) INDEPENDENT PORTION.
   A. *AUTOMATIC PORTION* has six positions: Release, Running, Holding, Lap, Service and Emergency.

   Release Position—Connects main reservoir direct to brake pipe through large ports. The distributing valve release pipe passage is blanked to hold locomotive brakes applied. Connection from main reservoir and brake pipe to equalizing reservoir is established and feed valve air flows through rotary and seat to warning port.

   Running Position—Closes direct opening from main reservoir to brake pipe and equalizing reservoir, also warning port, and connects from feed valve to brake pipe and equalizing reservoir. Distributing valve release pipe passage is open to atmosphere.

Holding Position—This feature is annulled. Port communication same as in running position.

Lap Position—Used to hold the brake applied after a service application. All ports are closed as far as functions are concerned.

Service Position—Used to apply brakes gradually by controlling the reduction in equalizing reservoir pressure at a predetermined rate through the preliminary exhaust port.

Emergency Position—Is used to vent brake pipe pressure directly and rapidly to atmosphere, causing venting devices to open and brakes to apply in emergency. Equalizing reservoir pressure is vented to atmosphere, main reservoir pressure is connected to the application cylinder pipe and sander valves if emergency sanding is used.

INDEPENDENT PORTION has five positions: Release, Running, Lap, Slow-Application and Quick-Application.

Release Position—Is used to release locomotive brakes after an automatic application. The application cylinder is connected to atmosphere at independent exhaust and reducing valve air flows through rotary valve and seat to warning port.

Running Position—Is used to release independent applications (providing automatic brake valve is in running position) and is position where handle should be kept when brake is not being used. The distributing valve release pipe is connected through rotary and seat to the exhaust of automatic brake valve.

Lap Position—Is used to hold the independent brake applied after desired cylinder pressure is obtained.

Slow-Application—Is used to apply locomotive brake slowly. Reducing valve pressure flows through restricted ports in rotary and seat to application cylinder pipe.

Quick-Application—Is used to apply the brakes quickly. Reducing valve air flows through large port to application cylinder pipe.

6. Q. What is a locomotive called when it has a brake valve and control stand at each end?

   A. A double-end locomotive.

7. Q. What is the purpose of the No. 6 distributing valve and how does it operate?

   A. To admit air to, and to exhaust it from, all brake cylinders on the locomotive, both in automatic and in independent application, and to maintain automatically the desired brake cylinder pressure regardless of cylinder leakage and variation in piston travel.

8. Q. What is the purpose of the transfer valve or H5 relay valves?

   A. To transfer the control of the brakes from one brake valve to another on double end control equipment or on single end control where locomotives are used in multiple unit service. (Locomotives in multiple unit service must have equalizing pipes coupled and cocks open between units.)

9. Q. What pressure is the safety valve set for on the distributing valve?

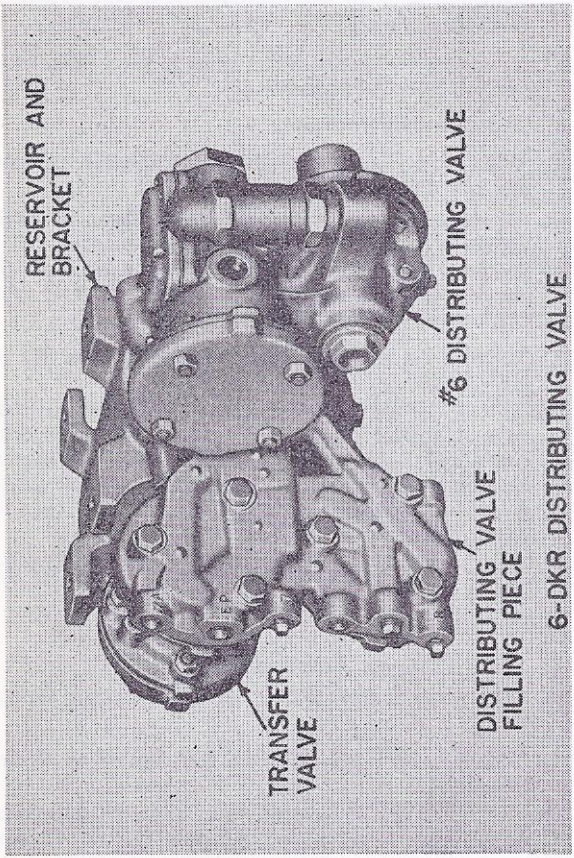
   A. 68 lbs.

10. Q. What is the vent valve used for?

    A. To propagate quick action during emergency application.

11. Q. Where is the equalizing reservoir located on electric locomotives?

    A. On DES-3 and P locomotives in brake valve pedestal, and all other locomotives under deck (10" x 14" reservoir).


RESERVOIR AND BRACKET
#6 DISTRIBUTING VALVE
TRANSFER VALVE
DISTRIBUTING VALVE FILLING PIECE
6-DKR DISTRIBUTING VALVE

12. Q. What type compressor is used on electric locomotives?
    A. CP-26, CP-35 and 3CMDC.
13. Q. How is the main reservoir pressure governed?
    A. By a governor.
14. Q. If governor fails, what protection is provided against excessive main reservoir pressure?
    A. A safety valve in main reservoir line set for 150 lbs.
15. Q. Do these locomotives have a train stop?
    A. No. they have Safety control equipment.
16. Q. How does it operate?
    A. The Safety Control feature provides automatic emergency brake application if for any reason the engineman becomes incapacitated by an emergency or is forced to leave his control station. Release of the safety control lever on the controller produces a quick interruption of power to traction motors and initiates an emergency brake application in approximately six seconds. Warning of safety control operation is given by an alarm inside locomotive cab.
17. Q. How can engineman leave his control station without brake applying in emergency?
    A. By applying the locomotive brake with cylinder pressure of not less than 35 lbs.
18. Q. What must engineman do before starting locomotive?
    A. Before starting the locomotive, the brake must be released. In order that the brakes can be released, the safety control lever on controller handle must be held down by hand; thereafter, either the safety control hand lever or the foot pedal on the floor may be used.
19. Q. What should be done if safety control applies while controller is open?
    A. Safety Control handle must be depressed and the controller moved to "OFF" position.

20. Q. Explain the use of the (3) position double heading cock, rotary and plug type?

A. #1 position, automatic brake valve, signal line and independent brake in operation.

#2 position, automatic brake valve, signal line and independent brake cut out and transfer valve cut in.

#3 position, automatic brake valve, signal line and transfer valve cut out and independent brake in operation.

WHEN LOCOMOTIVE IS DEAD

#1 position on either end not used.

#2 position, one end brake valve handle removed in handle off position (lap) transfer valve cut in.

#3 position, other end handle in running position, dead engine feature cut in.

21. Q. What is the difference between the rotary and the plug type cut out cock?

A. The rotary type has the dead engine feature in the bracket and the plug type has it as a separate feature, some on transfer valve bracket and others have dead engine feature in a separate valve.

22. Q. Where is the dead engine feature device located?

A. Classes—S-1, S-2, S-3, T-1, -2-3 & Q's—above deck. Class R&P—below deck.

23. Q. How many air gauges are used on electric locomotives and name them?

A. Two 3½" air gauges—main reservoir and equalizing reservoir and one brake pipe and brake cylinder.

24. Q. What type feed valves are used?

A. Two M-3 or F-6, one for brake pipe and one for straight air pressure.

25. Q. If brakes apply in emergency with an automatic service reduction, what might be the cause?

A. Equalizing reservoir reduction rate too fast.
Excessive brake pipe leakage.
¼" choke missing from brake pipe exhaust.
Defective brake pipe vent valve.

26. Q. What would cause a constant blow at the exhaust of the three position double heading cock?
A. Leaky double heading cock. If cock is in No. 1 position blow could be caused by leaky piston seal on transfer valve cylinder cover gasket.

27. Q. When equalizing piston fails to seat, how can it be determined whether it is caused by defective valve seat or equalizing reservoir leakage?
A. Defective valve seat will cause a continuous blow. Leak from equalizing reservoir or its connections will cause a blow only when brake valve handle is on lap.

28. Q. What could cause 14-EL brakes leaking off after an automatic service application—with brake valve handle in lap position?
A. Leak at application cylinder gasket, distributing valve gasket, or leak in application cylinder pipe. Leak in distributing valve release pipe or leak at safety valve.

29. Q. What will cause the main reservoir and brake pipe pressure to equalize with the brake valve in running position?
A. Leaky rotary valve, body gasket, feed valve or feed valve gasket, and dead engine fixture.

30. Q. What is used to compress air for air brakes?
A. An air compressor.

31. Q. For what are main reservoirs used?
A. To collect moisture and store a large volume of air for air brake system and auxiliary devices.

32. Q. What are the standard air brake pressures?
A. As prescribed in Rule 1512, Air Brake Book of Rules.

33. Q. Why must air brake system be kept free from leaks?
A. So air brakes will operate properly and to avoid wasteful work of air compressor.

34. Q. From where is air supply taken for the operation of sand blower, bell ringer, air whistle, control air pressure, independent brake and other air operated devices?
A. Main reservoir.

35. Q. How is air compressor driven?
A. Compressor is motor driven.

36. Q. How should main and sump reservoirs be drained and when?
A. Before leaving engine terminal and before each tour off duty, opening cock slowly to drain moisture.

37. Q. When must train line and air signal hose be blown out?
A. Before leaving engine terminal and again on the rear of units before attaching locomotive to train with care taken to avoid causing undesired emergency brake application. Be sure gaskets are in proper place.

38. Q. How must locomotive be moved in engine house territory and yard?
A. Locomotive must be moved safely and not in excess of a speed that would permit stopping short of any obstruction without sliding wheels of locomotives.

39. Q. What is purpose of compressor governor?
A. Used to control air compressor so that main reservoir pressure can be maintained within specified limits.

40. Q. If there is a constant blow at exhaust port of brake pipe vent valve or the vent valve causes undesired emergency, what must be done?
A. Plug exhaust port and report upon arrival at terminal.

41. Q. What is the purpose of the brake cylinder?
A. To transmit force to the brake shoes by means of rods and levers.

42. Q. What does line on end of cock plug indicate, regardless of position of handle?

A. Opening through valve.

43. Q. From what source is air drawn when making service application?

A. Equalizing reservoir.

44. Q. What is purpose of equalizing reservoir?

A. To provide volume above equalizing piston for controlling reduction of brake pipe pressure at a predetermined rate.

45. Q. What gauge hand must be observed in making a service application of brakes?

A. Equalizing reservoir hand.

46. Q. Where does brake cylinder air come from with independent or automatic brake application?

A. From main reservoir.

47. Q. What action must be taken to provide main reservoir air pressure when locomotive is handled DEAD in train, or when handled in train with air compressors inoperative?

A. Dead engine device cap or cutout cock must be placed in DEAD engine or open position.

48. Q. What is considered an application of brakes?

A. The first brake pipe reduction and all subsequent reductions until brakes are released.

49. Q. What must be done to minimize sliding of wheels?

A. Avoid high brake cylinder pressure at slow speed.

50. Q. When double-heading, from which locomotive should automatic brakes be controlled?

A. Brakes must be operated from leading locomotive; automatic brake valve on other locomotive must be cut out.

51. Q. What is the purpose of the feed valve?
A. To regulate brake pipe pressure.

52. Q. How is a feed valve pressure adjustment made?
A. By turning adjusting handle clockwise to increase pressure; counter-clockwise to decrease pressure.

53. Q. What is the purpose of a reducing valve?
A. Reducing valves are used to adjust main reservoir air pressure to the proper values needed for such purposes as independent brake, control air signal line, etc. Adjustment is made in the same manner as with feed valve, described above.

54. Q. Is it good practice to reverse locomotive while in motion with the locomotive brake applied?
A. No, as wheels will slide and reduce braking power.

55. Q. What effect has brake pipe leakage on application, control and release of brakes?
A. Waste air; takes away from engineman's ability to control amount of brake application and contributes to brakes sticking due to slow increase of brake pipe pressure.

56. Q. What comprises the air signal system?
A. A reducing valve and whistle sounding valve.

57. Q. If air signal line is not properly charged, what is the probable cause?
A. The reducing valve may be improperly adjusted or may be defective. There may be excessive signal line leakage.

58. Q. How are independent brakes controlled on trailing units of multiple unit road switch locomotives, or on units having double end controls?
A. By use of a transfer feature. In multiple unit service, equalizing pipe hose must be coupled and cocks open between units.

59. Q. Why must engineman know that various valves and cutout cocks of brake valve and control valve are in the proper position?

A. In order that the various valvular parts of the air brake equipment will operate as intended.

60. Q. How should the brakes be left on engine unattended?

A. Hand brake and independent brake applied, automatic brake in running position, throttle in idle, reverser in neutral, main switch out, and block wheels when necessary.

61. Q. When and how must needed repairs be reported?

A. Promptly and intelligently on the forms prescribed.

FIRST SERIES

NO. 14-EL. BRAKE EQUIPMENT ELECTRIC LOCOMOTIVES

The Relative Values of Answers in Per Cent

Question	Value	Question	Value	Question	Value
1	1	22	2	43	1
2	2	23	2	44	1
3	2	24	2	45	1
4	2	25	2	46	1
5	2	26	2	47	1
6	2	27	1	48	1
7	2	28	2	49	2
8	2	29	2	50	1
9	2	30	1	51	1
10	3	31	1	52	1
11	2	32	1	53	2
12	2	33	2	54	1
13	2	34	1	55	2
14	2	35	1	56	1
15	2	36	2	57	2
16	2	37	1	58	2
17	2	38	2	59	2
18	2	39	1	60	2
19	2	40	2	61	1
20	2	41	1		
21	2	42	1		
				TOTAL	100

SECOND SERIES OF QUESTIONS AND ANSWERS

SECOND SERIES EXAMINATION
DIESEL ELECTRIC LOCOMOTIVES

1. Q. What is essential to safety?
   A. Obedience to the rules.
2. Q. What is the main generator?
   A. Generator is an electrical machine having electrical conductors rotating past electro-magnetic poles so that mechanical energy may be converted into electrical energy.
3. Q. What is excitation?
   A. The condition necessary within the field windings of a generator to cause current to flow when the armature is rotated. It is produced by energizing the field windings.
4. Q. What is the purpose of main generator?
   A. To generate current to drive the traction motor.
5. Q. When is the main generator used as a motor?
   A. When cranking diesel engine.
6. Q. From what source is energy derived for starting diesel oil engine?
   A. By storage battery connected to the main generator thru starting contactors.
7. Q. What is an auxiliary generator?
   A. The auxiliary generator furnishes current for battery charging and low voltage circuits. Ammeter should never show a discharge, when engine is running.
8. Q. How are auxiliary generators driven?
   A. Auxiliary generators may be directly driven thru flexible couplings, belt driven or gear driven.
9. Q. How is battery charging regulated?
   A. By voltage regulator.
10. Q. What is the alternator?
    A. An electrical generator which produces alternating current.

11. Q. What is its purpose?
    A. To supply AC current for the traction motor blowers and radiator cooling fan motors.

12. Q. What is a traction motor?
    A. A variable speed DC motor geared to the driving axles.

13. Q. When are they used as generators?
    A. In dynamic braking when locomotive is moving and controls are in dynamic braking position.

14. Q. How is the current generated in traction motor dissipated in dynamic braking?
    A. Thru grids in the hatch of the unit which are cooled by a motor driven blower.

15. Q. What is meant by transition?
    A. Transition is the changing of traction motor connections to conform with required locomotive tractive effort and speed.

16. Q. What would cause power off switch or PC switch to function?
    A. Emergency application of brakes or train stop application.

17. Q. How would you recover from shutting engines down with a manual shut down device such as emergency stop button on throttle handle or engineman's control stand or engine shut down lever?
    A. Proceed as in starting the engine.

18. Q. How would you detect generator field switch or circuit breaker out or fuse blown?
    A. The engines would rev up but not load.
    Reset generator field switch or circuit breaker or replace fuse.

19. Q. How would you detect the starting contactors stuck and how would you recover?

A. Engine would not load. On some locomotives there is a light which indicates stuck starting contactors. Isolate engines, pry contactors apart with dry stick, then place engine on the line.

20. Q. What would be the effect on locomotives that have a train line air operated throttle if a leak should develop in the line?

A. Engines would not load properly especially to the rear of the leak.

21. Q. What would be the effect of loose or defective jumper cable between units?

A. Units to the rear of defective jumper cable would not load. This could be corrected by tightening loose jumper cable or replace defective jumper cable with spare carried on locomotive.

22. Q. How would you detect control fuse blown or control switch open or control circuit breaker out on a unit not equipped with M.U. control?

A. Locomotive would not respond to throttle.
Reset control switch or circuit breaker or replace control fuse.

23. Q. How would you detect control fuse blown, control switch open, or control circuit breaker open on unit or units equipped with M.U. control?

A. On a locomotive consisting of a single unit equipped with M.U. control, there are two control fuses, circuit breakers or switches. If either of the two is blown or open the locomotive will fail to respond to the throttle. *Both* should be examined and the situation corrected if necessary. On a locomotive consisting of two or more units all equipped with M.U. control if the M.U. control switch, circuit breaker (usually at engineman's station) or fuse (in low voltage cabinet) is open or blown, none of the units of the locomotive will respond to the throttle and the trouble is in the controlling unit.

If a control switch, circuit breaker or switch effecting the control circuit of one particular unit only is open or blown, that unit only will fail to respond to the throttle and the trouble is in that unit.

24. Q. How would you detect an alternator failure and how would you recover (DPA-5&6, DCA&B-1, DFA&B-2, DFA&B-6, DFA&B-9).

A. Considering a multiple unit locomotive if, with the engines on the line, the alternator on one unit fails to deliver power ("No AC power" on some classes) for the traction motor blowers and radiator fans, the engine on the unit concerned will be returned to idle unless the throttle is in numbers 5 or 6 positions in which case the engine stops. Alarm bells will sound in all units and the blue light will be on at the power plant concerned. Anytime an engine is stopped, the alternator fails to deliver power and, if the engine is on the line, the AC failure alarm will sound even though the engine was stopped by another safety device. To correct this condition, isolate the engine. This will put out the blue light and stop the bells. If the alternator fails with throttle in other than 5th or 6th notch, isolation of power plant indicated by blue light will put out the light and stop the bell. Making sure no other protective device is involved, stop engine. Reset alternator field circuit breaker or replace alternator field fuse. Start engine and place on line in prescribed manner.

25. Q. How would you test for leak in throttle air line on units equipped with air throttles?

A. When locomotive is standing place reverser in neutral and open throttle and check throttle line for leaks.

26. Q. What would cause low fuel oil pressure?

A. Plugged fuel oil filters or emergency fuel oil valve tripped or air leaks in the suction line. Defective fuel oil pump or pressure regulating valve, or frozen fuel oil lines, empty supply tank.

27. Q. What is the proper oil level for Woodward governors?

A. One half sight glass with engine running.

28. Q. What is the proper oil level for General Electric Governors?

A. Some locomotives have marked dip sticks level, and others have sight glass to determine the proper level. On units having a sight glass, about one half glass is sufficient.

29. Q. What is an electro-pneumatic valve?

A. An electrically actuated air valve.

30. Q. What is the purpose of a circuit breaker or fuse?

A. To protect a particular circuit from damage in event of electrical overload.

31. Q. How should a circuit breaker be reset or fuse replaced in engine control circuit?

A. Isolate engine, or place throttle in idle, placing the circuit breaker in the full "OFF" position, then "ON" position, and allow to cool if necessary before resetting or replacing fuse. Place engine on line or open throttle.

32. Q. What is the purpose of the scavenging air blower or turbo-supercharger?

A. The scavenging blower or turbo-supercharger supplies clean air to the cylinders after completion of firing stroke. This removes the exhaust gases and supplies air under a small pressure to provide better combustion. More power results for each piston stroke than with use of atmospheric air pressure.

33. Q. How will low turbo air pressure affect an oil engine?

A. Low turbo air pressure will prevent some of the fuel injected from burning because of insufficient air, causing excessive smoke and loss of power from that power plant. Pressure should be not less than 12 pounds per

square inch on road and road switch power, under full load.

NOTE: This could indicate defective turbo and should be reported.

34. Q. What is the purpose of the emergency fuel valve?
A. To shut off fuel flow between fuel tank and fuel pumps in case of fire or emergency.

35. Q. What is the purpose of the 5# sight glass of fuel pressure gauge?
A. To show that sufficient fuel is being supplied the oil engine.

36. Q. Trace the fuel system of an EMD type 567 engine.
A. Fuel is piped from the fuel tank sump to the fuel supply sump through the emergency fuel cut-off valve by gravity. The fuel pump then draws the fuel from the supply sump through piping and the suction filters to the engine room level. The fuel pump then discharges fuel into the discharge filters and from there to the fuel supply headers on each side of the engine through a pressure regulating and filtering device. Jumper lines from the headers carry fuel to the unit injectors. More fuel than is admitted to the cylinder passes through the injector for cooling purposes. The excess fuel returns from the injector of each cylinder to return headers on each side of the engine, and from there passes into the fuel supply tank.

Q. Trace the fuel system of an Alco type 244 (Vee) engine.
A. The fuel pump draws fuel from a point near the bottom, up through an emergency fuel cut-off valve and suctions filters and discharges through a "pressure relief valve" to protect the fuel pump against overload. The fuel passes through a discharge filter after the "pressure relief valve" and from there to the right bank fuel header. The right bank header is connected

to the left bank header by a cross-over line at the generator end of the engine. Individual high pressure fuel pumps operated by the engine cam shafts take fuel as required from the large supply in the headers for metered injection to the fuel nozzles. The fuel injection nozzles are so designed as to permit slight leakage between the nozzle valve and the nozzle body for lubrication. This leakage is collected in headers on both sides of the engine and piped back to the fuel tank. At the end of the left bank header is a pressure regulating valve which maintains constant fuel pressure in the headers. Its discharge line returns excess fuel to the fuel tank.

Q. Trace the fuel system of a Fairbanks-Morse opposed piston engine.

A. An engine driven supply pump draws fuel from the fuel tank through the emergency fuel cut-off valve and suction strainer and discharges through a pressure regulating valve for maintaining constant fuel pressure to a fuel discharge filter. From the fuel discharge filter, the fuel passes to the right engine fuel supply header then through a crossover pipe to the left engine fuel supply header. Injection pumps draw from these headers to supply the fuel nozzles in the cylinders. Leak off and drainage from injection pumps and nozzles is piped back to the fuel tank.

Q. Trace the fuel oil system of the Baldwin VO, Baldwin 600 and Lima engines.

A. The fuel oil is drawn from the fuel tank through an emergency fuel cut-off valve and then a suction strainer to the fuel pump. The fuel pump discharges fuel to the fuel oil discharge filters and is protected against overload by a relief valve. From the filters the fuel is delivered to a header on the right side of the engine. Individual high pressure pumps and nozzles deliver fuel to each cylinder. A relief valve is in the line after the end of the header to maintain proper pressure. It dis-

charges back to the fuel tank. Injection nozzle and pump leak-off is drained back to the fuel oil tank.

37. Q. How does the lube oil system function? (E.M.D.)

A. The lube oil is drawn from the sump by the scavenging oil pump up through the sump oil strainer, then passes through the scavenging oil pump. The scavenging oil pump then forces the oil through the lube oil filter then up through the lube oil cooler and back down to the lube oil suction strainers. The oil is then drawn up by the lube oil and piston cooling pump and is discharged under pressure through separate piston cooling oil pump and lube oil pressure pump discharge elbows to the manifold connections on the accessory gear cover. The piston cooling oil is delivered from there to the two piston cooling header pipe and then to piston cooling "pee" pipes which direct a stream of oil on to the under side of each piston to cool it. The lube oil is delivered to the main "V" shaped oil header running throughout the length of the crankcase. Pressure oil in the "V" shaped header flows down the main bearing "A" frame oil tubes to lubricate the main bearings, then through drilled passes in the crankshaft to the connecting rod bearings. Leak off oil lubricates the thrust bearings. The harmonic balancer and accessory drive gear assembly are lubricated by oil flowing from the #1 main through drilled holes in the crankshaft. Oil flowing from the rear end of the "V" shaped main bearing oil header lubricates the gear bearings in the camshaft and blower drive and passes into the camshaft. Camshaft bearings are lubricated by drilled holes in each bearing segment. Rocker arm shaft bushings, cam follower roller bushings and hydraulic lash adjusters are all lubricated through drilled holes and passages by oil from the camshaft segments. Leak off oil from the camshaft and rocker arms flows across the tops of the cylinder heads and drains down through drain pipes to the oil sump.

Q. How does the lube oil system function? (Alco)

A. With the engine operating, the lubricating oil pump draws the hot dirty oil from the base and discharges it to the system under high pressure. This pressure is regulated by a pressure regulating valve mounted in the pump discharge line. The oil is then passed thru a filter where it is cleaned, it is then piped to a cooler where a portion of the heat is absorbed by the engine cooling water. From the cooler the oil is then piped to a strainer then to the main header of the engine. Just before it enters the main header a portion of it goes to the valve lever mechanism, camshaft bearings, gear trains and turbo-supercharger bearings, returning to the engine base through various drain lines.

Individual jumper pipes conduct the oil from the main header to each main bearing. Drilled passages in the crankshaft allows the oil under pressure to flow from the main bearing journals to the connecting rod bearing journals. From the connecting rod bearing journals it passes up through rifled drilled connecting rods to hollow piston pins, lubricating the piston pin and bushing. Through a passage in the main pistons, oil flows from the piston pins to oil cooling grooves in the pistons terminating in an outlet hole and draining back to the engine base. At the end of the main engine header, a line leads to the engine control panel terminating in a pressure gauge and two low oil pressure switches which protect the engine against loss of lubricating oil pressure.

Q. How does the lube oil system function? (F.M.)

A. The engine driven lubricating oil pump draws oil from the engine crankshaft through a coarse strainer, and pumps it through the 6-element filter to the oil coolers. Here, the oil is circulated around water cooled tubes and then piped through a fine strainer to the engine oil headers. Flow continues through engine parts and back to the crankcase.

Q. How does the lube oil system function? (Lima-Hamilton)

A. The lubricating oil system is a pressure system of the dry sump type using two positive displacement gear type pumps combined in a single unit. The inner pump delivers oil to the engine from the supply tank through a strainer to the main bearing lube oil header from which it is distributed to the main bearings, crank pin bearings, connecting rods, wrist pins, piston crowns for cooling, cylinder head valve rockers and turbocharger. The outside pump takes oil from the engine pan through a suction screen to the lube oil filter, lube oil cooler and back to the supply tank.

Q. How does the lube oil system function? (Baldwin 600 Series)

A. A positive displacement gear pump, chain driven from the crankshaft at the pump end of the engine, draws the lubricating oil from the engine base and circulates it through the system. The oil passes through a suction strainer before entering the pump. After leaving the pump the oil passes through a full flow filter, a metal edge strainer and a heat exchanger before entering the engine distributing system.

The engine distributing system supplies oil under pressure to all engine bearings, camshaft and pump chain drives, valve rocker arms and push rods, also for piston cooling. The cams, rollers and guides for the push rods and fuel pumps are splash lubricated from oil contained in the camshaft trough. The push rod roller guides are also lubricated by oil draining down along the push rods from the valve rocker arms. The oil in the camshaft trough is replenished continuously from the engine pressure system and is kept at a constant level by means of overflow connections to the crankcase. An engine shut-down device is provided which will stop the engine if the lubricating oil pressure drops below 15 pounds pressure.

Q. How does the lube oil system function? (Baldwin VO Engines)

A. Same as Baldwin 600 series except the engine is equipped with a hand pump which is used for filling the system when starting the engine the first time after overhauling, or if engine has been idle 24 hours or longer.

38. Q. What is the principle of the cooling system?

A. The principle of cooling is the pumping of water by gear driven centrifugal water pumps which draw the water from a water supply tank, force it thru a header, which carries the water to the cylinder liners and heads, then thru a series of cooling cores or radiators, thru the lube oil cooling core, returning water to line from the water supply tank. Water is supplied thru various fillers provided under the car body and in emergency filled thru roof fillers.

39. Q. How is the cooling water cooled?

A. Outside air is drawn in through shutters and radiators and absorbs heat from the water as it passes by the thin walled water passages in the radiators. The heated air still moved by fan action then passes out of the unit. The quantity of air flowing through the radiators controls the engine cooling water temperature. Thermostatic controls which change fan speed or open and close shutters automatically or both. In addition, some units have manual shutter controls which permit increase or decrease in restriction of air passage through the radiator thereby allowing suitable engine cooling water temperature to be maintained.

E.M.D. ROAD PASSENGER AND ROAD SWITCH AND FREIGHT

40. Q. How is a shut-down engine protected in freezing weather?

A. If an engine is to be shut down in freezing weather it

must either be drained or heated by steam from an outside source connecting to the steam train line of the locomotive. 1. See that all radiator shutters are closed. 2. Supply steam to the cooling water system by opening the steam admission valve direct to the cooling system of each engine, located at floor level at accessory end of engine. 3. Open the "G" valve. 4. Drain toilet water tanks. 5. Protect the steam generator according to proper instructions.

ELECTRO-MOTIVE SWITCH LOCOMOTIVES CLASS DES-4 567-573 (Incl.)

Q. How is a shut-down engine protected in freezing weather?

A. To drain E.M.D. engines:

1. Open "G" valve.
   Open main drain valve, Fireman's side at accessory side of engine, open both by-pass valves on accessory end of engine.
2. Remove pipe plugs from bottom of both water pumps.
3. Open cab heater valves.
4. Drain water cooler
5. Protect steam generator according to special instructions.
6. Drain toilet water tank.
7. On locomotives equipped with immersion heaters follow proper instructions for use of immersion heaters (electric power available) in lieu of draining.

ELECTRO-MOTIVE SWITCH LOCOMOTIVES DES-5, 6 and 16, 575-609 (Incl.), 617-621 (Incl.), 650-704 (Incl.), 8835-8899 (Incl.), 8900-8999 (Incl.), 9000-9008 (Incl.)

Q. How is a shut-down engine protected in freezing weather?

A. 1. Draining (no electric power or steam available).

If engine cannot be started and there is danger of freezing cooling water system, drain all water as follows:

a. Open cab heater valves.
b. Open four drain valves at front of engine at floor level.
c. Open "H" or "G" overflow valve.
d. Remove plug at bottom of water pump.
e. On locomotives equipped with immersion heaters drain heater pump.

ALCO ROAD PASSENGER

Q. How is the shut-down engine protected in freezing weather?

A. If the engines are to be shut down during a layover in freezing weather, they must be either drained or heated by steam from an outside source, connection to the steam train line of the locomotive.

For protection against freezing take the following steps:

1. See that all radiator shutters are closed. 2. If steam is available supply steam to engine and cooling water system by opening steam admission valves. 3. Drain toilet water tanks. 4. Protect steam generator according to proper instructions.

In case steam is not available proceed as follows:

1. Drain engine.
   a. Open drain valve at base of oil cooler.
   b. Remove plug in bottom of water pump.
   c. Open both valves to each cab heater.
2. Drain toilet water tanks.
3. Drain steam generator according to proper instructions.

ALCO ROAD SWITCH UNITS 8100-8113 (Incl.)

Q. How is a shut-down engine protected in freezing weather?

A. If engines are to be shut down during freezing weather

they must be drained. To drain proceed as follows:

1. Remove driving coupler on water fill line.
2. Open the following valves:
   a. Fill-drain valve.
   b. Engine drain valve.
   c. Turbocharger valve.
   d. Cab heater valve.
   e. Cab heater vent valve.
3. To drain steam generator proceed according to proper instructions.

ALCO ROAD SWITCH UNITS 8200-8357 (Incl.)
ALCO FREIGHT UNITS 1000-1123 and 3300-3372 (Incl.)

Q. How is a shut-down engine protected in freezing weather?

A. If engines and steam generators are to be shut down in freezing weather they must be drained. To drain engine proceed as follows:

1. Open filler drain valve.
2. Open inlet valve at cab heater.
3. Open outlet valve at cab heater.
4. Open cab heater vent valves.
5. Remove drain plug at bottom of right water pump.
6. Protect steam generator according to proper instructions, if equipped.

ALCO SWITCH UNITS DEs-7 800-810 (Incl.)

Q. How is a shut-down engine protected in freezing weather?

A. 1. If engine cannot be started and there is danger of freezing the cooling water system, drain as follows: (no electric power or steam available).
   a. Open main drain valve (rear end of locomotive hood near cab).
   b. Open valve in piping from engine block. Engineman's side.
   c. On locomotives equipped with immersion heaters drain heater pump.

2. On locomotives equipped with immersion heaters follow proper instructions for use of immersion heater (electric power available).

ALCO SWITCH UNITS DEs-8, 9 and 11, 811-863 (Incl.), 900-907 (Incl.), and 8500-8667 (Incl.)

Q. How is a shut-down engine protected in freezing weather?

A. 1. If engine cannot be started and there is danger of freezing the cooling system (no electric power or steam available), proceed as follows:
   a. Open main drain valve near front of engine on fireman's side.
   b. Open valve in piping from engine block.
   c. Open cab heater valves.
   d. On 1000 h.p. engines Class DEs-11, open drain valve at turbocharger.
   e. On locomotives equipped with immersion heaters drain heater pump.

2. (Electric power available.) On locomotives equipped with immersion heaters follow proper instructions for use of heaters.

FAIRBANKS-MORSE FREIGHT UNITS 5000-5005 (Incl.), and 5100-5101 (Incl.)

FAIRBANKS-MORSE ROAD PASSENGER UNITS 4400-4405 (Incl.)

Q. How is a shut-down engine protected in freezing weather?

A. If the engines are to be shut down during a layover in freezing weather they must either be drained or heated by steam from an outside source, connection to the steam line of the locomotive. For protection against freezing take the following precautions:

1. See that all radiator shutters are closed.
2. Supply steam to the engine cooling water system

by opening the steam admission valve No. 2. Open Valve No. 1 to supply steam to the cooling water tanks and piping.

3. Open the "low level" (located near the front end of the left hand water tank) to prevent radiators from filling with water as the heating steam condenses in the system.
4. Open valves No. 3 and 4 to provide heating steam for the cab heaters. Be sure that No. 3 is open before opening No. 4 in order to have the heaters full of water when steam is admitted.
5. Drain toilet water tanks.
6. Drain steam generator according to proper instructions.

In case heating steam is not available:

1. Drain all cooling systems by opening all drain valves provided in piping system.
2. Remove: Lower drain plugs of both exhaust manifold water jackets, adjacent to No. 10 cylinder (two on each side). Drain plugs on the underside of both "L"water jackets (two). Drain plug on the water inlet header nameplate (one). Drain plugs on the under side of the oil cooler heads (two).
3. Empty water treatment device if used.
4. Drain toilet water tanks.
5. Drain cab heaters.
6. Drain steam generator according to proper instructions.

FAIRBANKS-MORSE ROAD PASSENGER UNITS 4500-4507 (Incl.)

Q. How is a shut-down engine protected in freezing weather?

A. If the engines are to be shut down during the layover in freezing weather, they must be either drained or heated by steam from an outside source connecting to the steam trainline of the locomotive.

1. See that all radiator shutters are closed.
2. Supply steam to the cooling water system by opening valve in steam line to engine water tank. Valves located on floor just ahead of the left engine room side door.
3. Open valve in steam line to engine water jacket. Valve is located at the pump end of the engine.
4. Open valve in steam line to cab heaters. Valve is located overhead in the nose. Always have water on the same time as steam, as steam alone will melt the heater elements.

CAUTION: Do not admit steam to the cooling system or cab heaters when the engine is running.

5. Protect steam generator according to proper instructions.

FAIRBANKS-MORSE FREIGHT UNITS

5006-5017 (Incl.), 5102-5104 (Incl.), 6600-6607 (Incl.), 6900-6903 (Incl.)

Q. How is a shut-down engine protected in freezing weather?

A. If the engines are to be shut down during a layover in freezing weather, they must be drained. To drain proceed as follows:

1. Open main cooling valve on tank.
2. Remove plug from water pump, right bank accessory end.
3. Open drain valve pump end of engine.
4. Drain cab heater.
5. Drain toilet water tank.

FAIRBANKS-MORSE ROAD SWITCH UNITS

Q. How is a shut-down engine protected in freezing weather?

A. If engines are shut down during the layover in freezing

weather, they must be drained or protected by stand by heater. To drain proceed as follows:

1. Open main cooling drain valve located at floor level at accessory end of engine. Valve V8 should be open.
2. Remove plug from water pump accessory end.
3. Drain cab heaters.

FAIRBANKS-MORSE SWITCH UNITS CLASS DEs-14 9100-9110 (Incl.)

Q. How is a shut-down engine protected in freezing weather?

A. If the engine cannot be started and there is danger of freezing, drain all water as follows:

1. Open the two drain valves (V1 and V2) located in the small pipe between the radiator and engine.
2. Open drain valve V15 located within hood number 1 end on floor, in 1 inch line.
3. Open drain valves (V3 and V4) located in pipe between engine and radiator.
4. Remove plugs on bottom of water pump.
5. Drain cab heater.

FAIRBANKS-MORSE SWITCH UNITS CLASS DEs-17 9111-9137 (Incl.)

Q. How is a shut-down engine protected in freezing weather?

A. If engine cannot be started and there is danger of freezing the cooling system, drain all water as follows:

1. Open drain valve 29.
2. Open drain valve 26.
3. Remove drain plugs on bottom of water pump.
4. Drain cab heater.

BALDWIN-LIMA-HAMILTON FREIGHT UNITS 3800-3803 (Incl.), 3804-3821 (Incl.), 3700-3701 (Incl.), 3702-3709 (Incl.)

Q. How is a shut-down engine protected in freezing weather?

A. If engines are to be shut down during a layover, they must be drained. To drain proceed as follows:

1. Open main cooling valve at accessory end of engine.
2. Remove plug from water pump, right bank accessory end.
3. Drain cab heaters.
4. Drain toilet water tanks.

LIMA-HAMILTON ROAD SWITCH UNITS 6200-6215 (Incl.)

Q. How is a shut-down engine protected in freezing weather?

A. If the engines and steam generator are to be shut down during a layover, they must be drained. To drain proceed as follows:

1. Open main cooling system drain valve located at floor level at accessory end of engine.
2. Remove plug from right bank water pump.
3. Drain toilet water tank.
4. Protect steam generator according to proper instructions.
5. Drain lube oil heat exchanger.
6. Drain turbo-charger.
7. Drain cab heater.

BALDWIN-LIMA-HAMILTON ROAD SWITCH UNITS 6220-6236 (Incl.)

Q. How is a shut-down engine protected in freezing weather?

A. If engines are to be shut down during a layover in

freezing weather, they must be drained. To drain proceed as follows:

1. Open main cooling valve located at floor level at accessory end of engine.
2. Drain turbo-charger.
3. Drain cab heaters.
4. Remove plug from water pump right bank accessory end.
5. Protect steam generator according to proper instructions.
6. Drain boiler water.
7. Drain toilet water.

BALDWIN ROAD SWITCH UNITS 7300-7301 (Incl.)

Q. How is a shut-down engine protected in freezing weather?

A. If engines are to be shut down during the layover in freezing weather, they must be drained. To drain proceed as follows:

1. Open main cooling drain valve located at floor level at accessory end of engine.
2. Remove plug from water pump accessory end.
3. Protect steam generator according to proper instructions.
4. Drain boiler water.
5. Drain cab heater.

BALDWIN SWITCH UNITS DEs-10 and 12 750-761 (Incl.) and 9300-9307 (Incl.)

Q. How is a shut-down engine protected in freezing weather?

A. 1. If engine cannot be started and there is danger of freezing the cooling system, proceed as follows: (no electric power or steam available).

a. Open main drain valve at front end of engine on fireman's side at floor level.

b. Remove plug from bottom of water pump.
c. On locomotives equipped with immersion heaters drain heater pump.

2. On locomotives equipped with immersion heaters follow proper instructions for use of immersion heaters (Electric power available).

LIMA-HAMILTON SWITCH UNITS CLASSES DEs-15, 19 and 20. 8400-8411 (Incl.), 9800-9820 (Incl.), and 9308-9328 (Incl.)

Q. How is a shut-down engine protected in freezing weather?

A. If engine cannot be started and there is danger of freezing the cooling system, drain cooling water system as follows:

1. Open cab heater valves.
2. Open drain valve located between engine and the radiator.
3. Open turbocharger drain valve.
4. Open drain valves on heat exchanger.
5. Remove plug on bottom of water pump.

41. Q. How should a standby immersion heater be used?

A. Shut down engine, open battery switch.

Plug power cable into receptacle on either side of locomotive.

Plug fits in only one way.

Pump pilot light should glow at once, when switch at source of current is closed.

Press test switch to see that heater pilot light glows.

If equipment does not function as above, restart engine immediately and report condition to the supervisor in charge before leaving locomotive. In disconnecting immersion heaters, open switch at electric power source and then remove plug from receptacle.

42. Q. Should speed of engines be controlled with lay shaft when putting engines on and off the line? (EMD)
A. Yes, if so equipped and operating conditions permit.

43. Q. What is a solenoid valve?
A. A magnetic coil which actuates a metal core to which a valve is attached to control the flow of air or liquid automatically.

44. Q. What is a contactor?
A. An electric connector for making or breaking an electric circuit.

45. Q. What is a relay?
A. An electrically actuated switch.

46. Q. What is a wheel slip relay?
A. In most cases a wheel slip relay is a device which is operated by a predetermined difference in voltage or amperage between two traction motors. Voltage or amperage differences in rotational speed. When the relay operates, it completes warning circuits which indicate wheel slip in the cab. The American Brake Shoe wheel slip control operates rotary switches actually mounted on the axles. All the devices in addition to activating a warning cause an automatic reduction in power on the power plant connected to the traction motor concerned.

47. Q. What should be done when an unusual noise or pound is detected in the oil engine?
A. Take the engine off the line and if noise or pound continues shut the engine down.

48. Q. What should be done in event of a hot engine?
A. Isolate the engine, check cooling water, lube oil level, fans and shutters. Allow engine to idle until normal temperature is attained. Put cooling system on manual if necessary.

49. Q. What is the normal temperature of an oil engine?
A. It varies on different locomotives and runs between 140 and 180 degrees.

50. Q. Name the different protective devices indicating lights which may be found on diesel.
A. Wheel slip light or buzzer.
PC or power off light.
Train stop check light.
Dynamic brake overload light.
Low oil light and governor shut down plunger.
Alternator failure light.
Steam generator alarm failure light.
Hot engine alarm light.
Ground relay alarm (Light when equipped).
Crankcase exhauster (Yellow light, lights when running).
Stuck starting contactors (Light when equipped).
The alternator light will light at anytime whenever the oil engine shuts down for any reason and the engine is on the line.

51. Q. What can be done if a fuel injector pipe or pump develops a leak enroute?
A. On oil engines so equipped, cut out the injector affected.

52. Q. What should be done if excessive fuel or lube oil leak develops enroute?
A. Shut down engine if leak cannot be corrected.

53. Q. Can a diesel be operated thru water?
A. Not over a speed of 3 miles per hour and not over a depth of 3 inches above top of rail.

54. Q. What is the purpose of throttle?
A. The lever or handle at the engineer's control stand which controls the engine governor or governors con-

cerned. Positioning of this lever will regulate the speed of the engine or engines.

55. Q. How many positions are there on the throttle lever?

A. On throttles with "notches" or "clicks," there is "Idle" plus 8 positions each representing a particular engine speed. These throttles control governors electrically. On throttles which control governors through air or mechanical linkage there are no notches and any engine speed may be selected from "Idle" to full RPM.

NOTE: EMD and some Fairbanks-Morse units have throttles equipped with "Stop" buttons in the end. Thumb pressure permits these throttles to be moved forward one "notch" further than "Idle." This move will stop all engines.

56. Q. What are the positions on the transition lever when present?

A. The positions are Braking, Off, 1, 2, 3 and 4.

57. Q. Describe the reverser and its purpose?

A. The reverser is an air operated reversing switch. Its purpose is to change the direction of flow of current thru the traction motor fields, thus reversing the rotation of traction motors.

SECOND SERIES EXAMINATION

DIESEL ELECTRIC LOCOMOTIVES

The Relative Values of Answers in Per Cent

Question	Value	Question	Value	Question	Value
1	1	20	2	39	2
2	1	21	1	40	6
3	1	22	3	41	1
4	1	23	4	42	1
5	1	24	4	43	1
6	1	25	1	44	1
7	1	26	2	45	4
8	1	27	1	46	1
9	1	28	1	47	1
10	1	29	1	48	1
11	1	30	1	49	1
12	1	31	2	50	4
13	1	32	3	51	1
14	1	33	4	52	1
15	1	34	1	53	1
16	1	35	1	54	4
17	1	36	3	55	1
18	1	37	3	56	4
19	1	38	3	57	4
				TOTAL	100

SECOND SERIES — AIR BRAKES

1. Q. Why is the brake automatic?

   A. Normally brake pipe auxiliary and pressure chamber pressures are the same or equalized. Any reduction in brake pipe pressure that will disturb equalization of these pressures will automatically cause all brakes to apply.

   NOTE—Name valvular portions of 6-SL, 6-BL, 6-DS and 14-EL brake equipment.

   1. Automatic brake valve.
   2. Independent brake valve.
   3. Brake pipe feed valve.
   4. Control air reducing valve.
   5. Air signal reducing valve (some units).
   6. Air signal whistle valve (some units).
   7. Air signal and check valve (some units).
   8. Compressor governors.
   9. Safety valve.
   10. Brake application valve (Loco. equipment for train stop).
   11. Distributing valve.
   12. Independent reducing valve (14-EL only).
   13. Dead engine fixture.
   14. Brake pipe cutout cock (double-heading cock).
   15. Brake pipe vent valve (some units).
   16. Transfer or relay air valve (Loco. equipment for MU service).
   17. Emergency relay valve (some units).

   NOTE—Name valvular portions of 24-RL brake equipment.

   "A" Units

   1. Automatic brake valve.
   2. Independent brake valve.
   3. Brake pipe feed valve.
   4. Control air reducing valve.
   5. Air signal reducing valve.
   6. Air signal whistle valve.
   7. Air signal strainer and check valve.

8. Compressor governor.
9. Safety valve.
10. Brake application valve.
11. Control valve.
12. Brake cylinder relay valve.
13. Rotair valve.
14. Relay air valves (1 to 3 portions).
15. Double check valve (some units).
16. Main reservoir cutoff valve (some units).
17. Emergency valve (Conductor's valve).

"B" Units

1. Brake cylinder relay valve.
2. Control valve.
3. Brake pipe feed valve.
4. Control air reducing valve.
5. Hostler's brake valve.
6. Main reservoir cutoff valve (some units).
7. Emergency valve (Conductor's valve).
8. Compressor governor.
9. Safety valve.

2. Q. What is the purpose of the distributing valve?

   A. Charging the pressure chamber and distributing the air to and from all brake cylinders on locomotive to apply and release brakes and to maintain brake cylinder pressure against leakage.

3. Q. What is the purpose of vent valve?

   A. The vent valve provides a means of propagating emergency action of brakes when service rate of reduction is exceeded.

4. Q. If emergency relay valve or vent valve becomes defective, causing undesired emergency or constant blow at exhaust opening and brake pipe cannot be charged, what should be done with #6 equipment?

   A. Plug exhaust opening of emergency relay valve or No. 4 vent valve with 1" pipe plug. If KM type of vent valve, loosen cap screw at exhaust port opening and turn blanking cover.

5. Q. From what source is air drawn when making service application?
   A. Equalizing reservoir.
6. Q. What is purpose of equalizing reservoir?
   A. To provide volume above equalizing piston for controlling reduction of brake pipe pressure at predetermined rate.
7. Q. What effect will leak from equalizing reservoir or connections have?
   A. Cause equalizing piston to rise and apply brakes when brake valve handle is in lap position.
8. Q. What is purpose of safety valve used on distributing valve and control valves?
   A. To limit maximum brake cylinder pressure in service braking.
9. Q. What is the function of controlled emergency?
   A. With controlled emergency cock in "F" position or rotair valve in either "FRT" or "FRT. LAP" position, in an emergency brake application, the development of locomotive brake cylinder pressure is controlled, or delayed, for purpose of allowing adjustment of train slack before locomotive brake applies to maximum pressure.
10. Q. Where is the controlled emergency cock located on 8-EL brake equipment and how positioned?
    A. On right side of independent brake valve, positioned in "P" position for light or passenger, and "F" for freight.
11. Q. Where is the controlled emergency cock located on 24-RL equipment and how must it be positioned?
    A. On the "B" units the controlled emergency cock is located on the control valve and must be positioned in "P" position for passenger or light movement, and "F" for freight only when coupled to a train.
    On the "A" units the rotair valve functions to position the controlled emergency feature and no cutout cock is needed on the control valve.

12. Q. What is the function of a rotair valve (24-RL equipment)?

A. The rotair valve combines in one valve certain operations which would otherwise require several independent cutout cocks.

The rotair valve accomplishes the following functions in the four handle position:

"FRT"—The independent brake valve and the controlled emergency feature are both cut in and operative.

"FRT. LAP"—The independent brake is cut out but the controlled emergency feature is retained and operative.

"PASS. LAP"—Both the independent brake and the controlled emergency feature are cut out.

"PASS."—The independent brake is cut in but the controlled emergency feature is cut out or annulled.

13. Q. Where is rotair valve located and how must it be positioned?

A. Located near Engineer's control stand and positioned as follows:

Passenger or Light

Place rotair valve in leading cab in "Pass." position. Trailing "A" unit must be in "Pass. Lap" position.

Freight

Place rotair valve in leading cab in "FRT" position. Trailing "A" unit must be in "FRT. LAP" position.

14. Q. What position should rotair valve be in when moving engine around engine terminal or yard?

A. In "Pass." position.

15. Q. If rotair valve was left in lap on leading or single unit, would you have independent brake?

A. No.

16. Q. What is considered an application of brakes?
    A. The first brake pipe reduction and all subsequent reductions until brakes are released.

17. Q. What must be done to minimize sliding of wheels?
    A. Avoid high brake cylinder pressure at low speed.

18. Q. What brake pipe reduction is required to make a full service application?
    A. 25 lbs.

19. Q. Is the release position on 24-RL direct or indirect?
    A. Indirect through the feed valve.

20. Q. Explain briefly the operation of air compressor.
    A. The air compressor is usually driven by the main engine crank-shaft or by separate motor and inasmuch as the locomotive engine may be operated at idling speed when motive power is not needed, it is necessary for the compressor to run continuously, thus requiring a load and unload type of control.

    The compressor may have one or more air cylinders, but the most common type now in use is the compound, having two low pressure air cylinders and one high pressure air cylinder with other necessary parts such as crank-case, crank-shaft, pistons, piston rings, oil pump, air valves and intercooler.

    On the down stroke of the low pressure pistons, atmospheric air is drawn through strainers or filters past the open intake valves into the low pressure cylinders. The intake valves then close. On the up stroke of the low pressure pistons the air is compressed, opening the low pressure discharge valves and flows to the intercooler. On the down stroke of the high pressure piston air from the intercooler is drawn into the high pressure cylinder past the high pressure intake valves, after which the high pressure intake valves close. On the up stroke of the high pressure piston the air is compressed to the final stage, opening the high pressure discharge valves and

flows to the discharge pipe, radiation pipe, and the main reservoirs. Then the high pressure discharge valves close.

The main bearings and connecting rod bearings are lubricated by oil under pressure from the crank-case by means of an oil pump driven by an eccentric at one end of the crank-shaft. Other internal parts are lubricated by splash and dash or spray system.

21. Q. Explain operation of compressor governor.

A. When maximum main reservoir pressure (140 lbs.) is obtained, the governor functions to admit air to unloader pistons or diaphragm above the high and low pressure intake valves which in turn block the valves off their seats, preventing further compression of air by the compressor. When the main reservoir pressure has reduced to the minimum (130 lbs.) the air pressure is vented from above the pistons or diaghragms by the governor, allowing the intake valves to seat and the compressor to resume the compressing of air.

22. Q. With compressor operating, how much oil pressure should be shown on gauge?

A. Gardner-Denver—#5 to #15
Westinghouse—#20 to #50

23. Q. What is the purpose of the brake pipe feed valve?

A. To regulate brake pipe pressure.

24. Q. How is a feed valve pressure adjustment made?

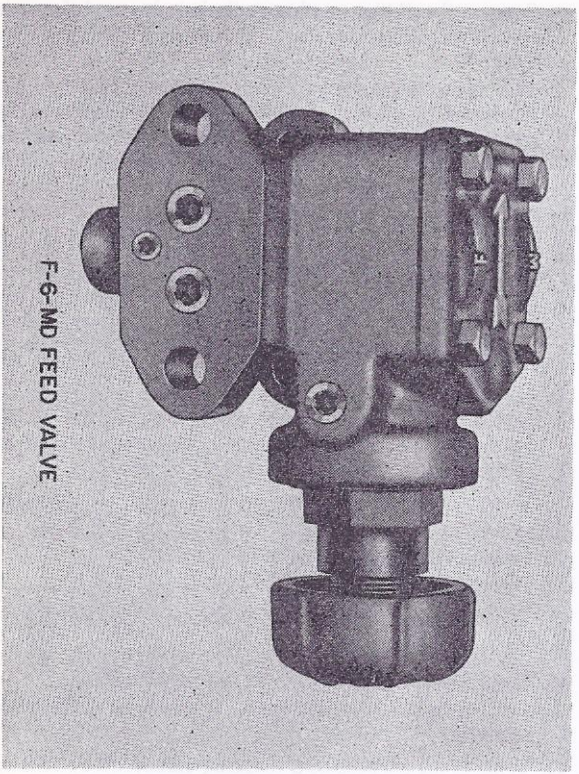
A. By turning adjusting handle clockwise to increase pressure.

25. Q. What is the purpose of a reducing valve?

A. Reducing valves are used to adjust main reservoir air pressure to the proper values needed.

26. Q. Explain purpose of various handle positions of automatic brake valves used with 14-EL, 6-BL and 6-SL brake equipment.

A. 1. Release Position: Connects main reservoir air

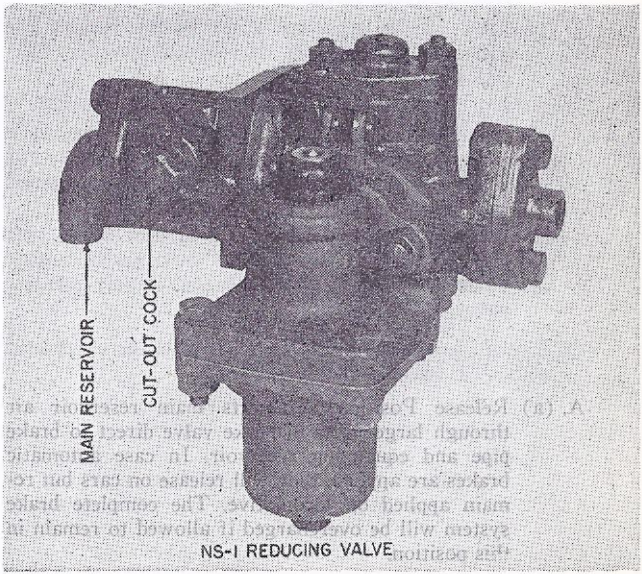


through large ports in brake valve direct to brake pipe and equalizing reservoir. In case locomotive brakes are applied, they will remain applied. The complete brake system will be overcharged if handle is allowed to remain in release position.

2. Running Position: Normal handle position for

charging brake system and releasing the brakes. Brake pipe and equalizing reservoir pressure being controlled by feed valve.

3. Holding Position: Holding feature annulled. (This position is same as running).
4. Lap Position: All operating ports are closed.
5. Service Position: Used to apply automatic brake gradually by controlling the reduction of equalizing reservoir pressure at a predetermined rate through the preliminary exhaust port.
6. Emergency Position: Is used to vent brake pipe pressure direct and rapidly to atmosphere, causing venting devices to open and brakes to apply in emergency.



NS-I REDUCING VALVE

27. Q. Explain handle position of automatic brake valve used with 6-DS brake equipment.

A. Same as answer to Question No. 26 next above as to items (2), (3), (4), (5) and (6), omitting (1) Release Position.

28. Q. Explain handle position of automatic brake valve used with 24-RL brake equipment.

A. (a) Release Position: In this position the function of brake valve is same as running position with feed valve controlling pressure to brake pipe.

(b) Running Position: Normal handle position for charging brake system and releasing brakes. Brake pipe and equalizing reservoir pressure being controlled by feed valve.

(c) First Service Position: First service feature has been annulled, making this position another "lap" position.

(d) Lap Position: All operating ports are closed.

(e) Service Position: Used to apply automatic brake valve gradually by controlling the reduction of equalizing reservoir pressure at a predetermined rate through preliminary exhaust port.

(f) Emergency Position: Is used to vent brake pipe pressure direct and rapidly to atmosphere, causing venting devices to open and brake to apply in emergency.

Q. Explain handle position of automatic brake valve used with 8-EL brake equipment.

A. (a) Release Position: Connects main reservoir air through large ports in brake valve direct to brake pipe and equalizing reservoir. In case automatic brakes are applied, they will release on cars but remain applied on locomotive. The complete brake system will be overcharged if allowed to remain in this position.

(b) Running Position
(c) First Service (Annulled—Same as Lap)
(d) Lap
(e) Service
(f) Emergency

} Functionally similar to 24-RL Brake Valve.

Q. Explain handle position of automatic brake used with D-22-L brake equipment.

A. (a) Release: Functionally the same as running position of 24-RL brake equipment.

(b) First Service (Annulled—Same as Lap)
(c) Lap
(d) Service
(e) Emergency

} Functionally silimar to 24-RL brake equipment.

NOTE: There is no full release position on this brake valve.

29. Q. Explain handle position of independent brake used with 8-EL and 14-EL brake equipment.

A. (a) Release Position: Is to release locomotive brake after an automatic brake application.

(b) Running Position: Is used to release independent application (provided automatic brake valve is in running position) and is position in which handle should be kept when brake is not being used.

(c) Lap Position: Is used to hold independent brake applied after desired cylinder pressure is obtained.

(d) Slow Application Position: Is used to apply locomotive brakes slowly. (Handle must be in this position when locomotive is left unattended.)

(e) Quick Application Position: Used to apply locomotive brakes quickly, and will annul controlled emergency if same is cut in on 8-EL.

30. Q. Explain handle position of self-lapping independent brake valve used with 6-DS, 6-BL, 6-SL, D-22-L and 24-RL brake equipment.

A. (a) Release Position: Is used to release independent application of locomotive brakes.
(b) Application Zone: To apply locomotive brake to any desired pressure up to setting of self-lapping portion.

31. Q. How can an automatic brake application on locomotive be released by use of self-lapping independent brake valve?
A. By depressing handle and bail of self-lapping independent brake valve in release position.

32. Q. Why is terminal test of brakes necessary?
A. To assure that all brakes function properly in accordance with Regulations and I.C.C. requirements.

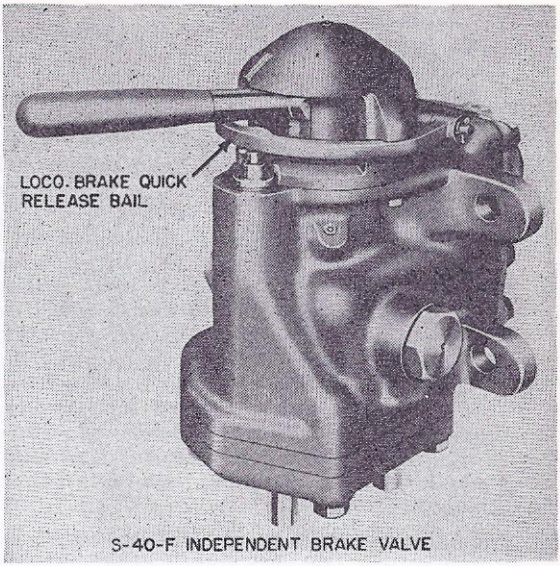
33. Q. What effect does piston travel have on locomotive brake operation?
A. Piston travel affects the time to develop brake cylinder pressures.

34. Q. What is the proper brake cylinder piston travel for a locomotive?
A. Piston travel should be in accordance with requirements of Rule 1514 of "Rules for the Operation and Supervision of Air Brake, Train Air Signal and Steam Heat Equipment, Locomotives and Cars."

35. Q. How is slack taken up in locomotive brakes?
A. By use of manual and automatic slack adjuster and pin take-up in rods as provided.

36. Q. Is it permissible to reverse locomotive while in motion with the locomotive brake applied?
A. No, as wheels may slide and reduce braking power.

37. Q. What effect has brake pipe leakage on application, control and release of brakes?
A. Waste air; takes away from engineman's ability to control amount of brake application and contributes to brakes sticking due to slow increase of brake pipe pres-



S-40-F INDEPENDENT BRAKE VALVE

sure. May increase rate of service reduction to point emergency occurs.

38. Q. When and how must needed repairs be reported?
A. Promptly and intelligently on the forms prescribed.

39. Q. In case of emergency, what means is available for applying the brakes other than with the brake valve?
A. Large capacity emergency valves have been provided at standardized locations for maximum safety.

40. Q. What is the cause of pneumatic control switch (PC) light on?
A. (a) Automatic train stop application.
(b) Emergency application of air brakes.

41. Q. How do you recover from each?

A. (a) To recover from train stop application, Lap automatic brake valve, place throttle in "Idle" position. After train has stopped, press reset button or operate reset cock. When (PC) light goes out, release brakes in the usual manner.

(b) To recover from Emergency Brake application, lap brake valve for 1 min., throttle in "Idle" position, then place automatic brake valve in running position. If (PC) light does not go out promptly, lap brake valve for 45 sec's. and again place brake valve in RUNNING position. If (PC) light does not go out, lap brake valve to save air supply, close brake pipe angle cock at rear of leading unit. Place brake valve in RUNNING position, PC light should go out promptly. If main reservoir pressure is low, place reverser in neutral, increase throttle until pressure is normal. Open brake pipe angle cock very slowly to prevent a re-application of locomotive brakes. Make a standing test of brakes in usual manner.

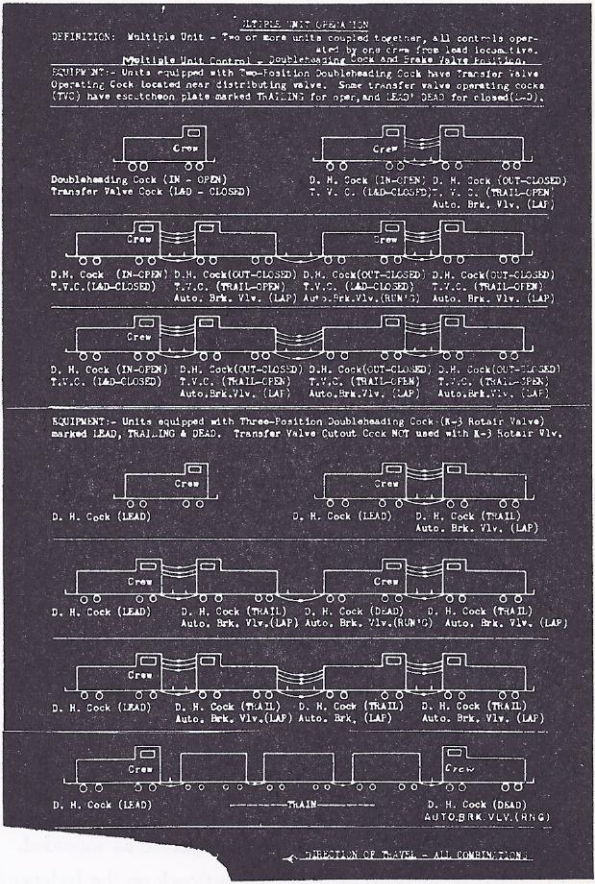
42. Q. How are independent brakes controlled on trailing units of multiple unit road switch locomotives, or on units having double end controls?

A. By use of a transfer feature incorporating either a transfer valve or a relay air valve. In multiple unit service, equalizing (brake cylinder) pipe hose must be coupled and cocks open between units.

43. Q. How is the transfer valve feature positioned for multiple unit locomotive?

A. (a) Trailing units having two-position double-heading cocks, must have the separate side-vented cutout cock in transfer valve operating pipe in "Trail" position (this cock must be in "Lead" position on leading units).

(b) The three-position double-heading cock on trailing units so equipped must be placed in TRAILING


MULTIPLE UNIT OPERATION
DEFINITION: Multiple Unit - Two or more units coupled together, all controls operated by one crew from lead locomotive.
Multiple Unit Control - Doubleheading Cock and Brake Valve Position.
EQUIPMENT:- Units equipped with Two-Position Doubleheading Cock have Transfer Valve Operating Cock located near distributing valve. Some transfer valve operating cocks (TVC) have escutcheon plate marked TRAILING for oper, and DEAD for closed(N-3).
Crew
Doubleheading Cock (IN - OPEN)
Transfer Valve Cock (LAD - CLOSED)
D. H. Cock (IN-OPEN) D. H. Cock (OUT-CLOSED)
T. V. C. (LAD-CLOSED), T. V. C. (TRAIL-OPEN)
Auto. Brk. Vlv. (LAP)
D.H. Cock (IN-OPEN) D.H. Cock(OUT-CLOSED) D.H. Cock(OUT-CLOSED) D.H. Cock(OUT-CLOSED)
T.V.C.(LAD-CLOSED) T.V.C. (TRAIL-OPEN) T.V.C. (LAD-CLOSED) T.V.C. (TRAIL-OPEN)
Auto. Brk. Vlv. (LAP) Auto.Brk.Vlv.(RUN'G) Auto. Brk. Vlv. (LAP)
D. H. Cock (IN-OPEN) D.H. Cock(OUT-CLOSED) D.H. Cock(OUT-CLOSED) D.H. Cock(OUT-CLOSED)
T.V.C. (LAD-CLOSED) T.V.C. (TRAIL-OPEN) T.V.C. (TRAIL-OPEN) T.V.C. (TRAIL-OPEN)
Auto.Brk.Vlv. (LAP) Auto.Brk.Vlv. (LAP) Auto.Brk.Vlv. (LAP)
EQUIPMENT:- Units equipped with Three-Position Doubleheading Cock (K-3 Rotair Valve) marked LEAD, TRAILING & DEAD. Transfer Valve Cutout Cock NOT used with K-3 Rotair Vlv.
D. H. Cock (LEAD)
D. H. Cock (LEAD) D. H. Cock (TRAIL)
Auto. Brk. Vlv. (LAP)
D. H. Cock (LEAD) D. H. Cock (TRAIL) D. H. Cock (DEAD) D. H. Cock (TRAIL)
Auto. Brk. Vlv.(LAP) Auto. Brk. Vlv.(RUN'G) Auto. Brk. Vlv. (LAP)
D. H. Cock (LEAD) D. H. Cock (TRAIL) D. H. Cock (TRAIL) D. H. Cock (TRAIL)
Auto. Brk. Vlv.(LAP) Auto. Brk. (LAP) Auto. Brk. Vlv. (LAP)
D. H. Cock (LEAD)
TRAIN
D. H. Cock (DEAD)
AUTO.BRK.VLV.(RN'G)
DIRECTION OF TRAVEL - ALL COMBINATIONS

position (or #2 position) with handle stop lug opposite letters "TRL'G."

(c) Double-heading cock on leading unit must be in lead (open #1) position.

44. Q. What is the purpose of the N-1-A brake application valve on road switch locomotives?

A. To apply the automatic brake in SERVICE application independently of the automatic brake valve during train stop applications.

45. Q. What is the purpose of the brake pipe cut-off valve?

A. To close feed valve communication to brake pipe when brake application valve has moved to applied position, preventing recharge of brake pipe until application valve is re-set.

46. Q. Where is the brake pipe cutout cock (Double-heading Cock) located on locomotives having D-22-L brake equipment?

A. Front end of engine room, right side.

47. Q. What is the purpose of the brake pipe cutout cock (Double-heading Cock)?

A. To cut out the automatic brake valve and train stop on trailing "A" units.

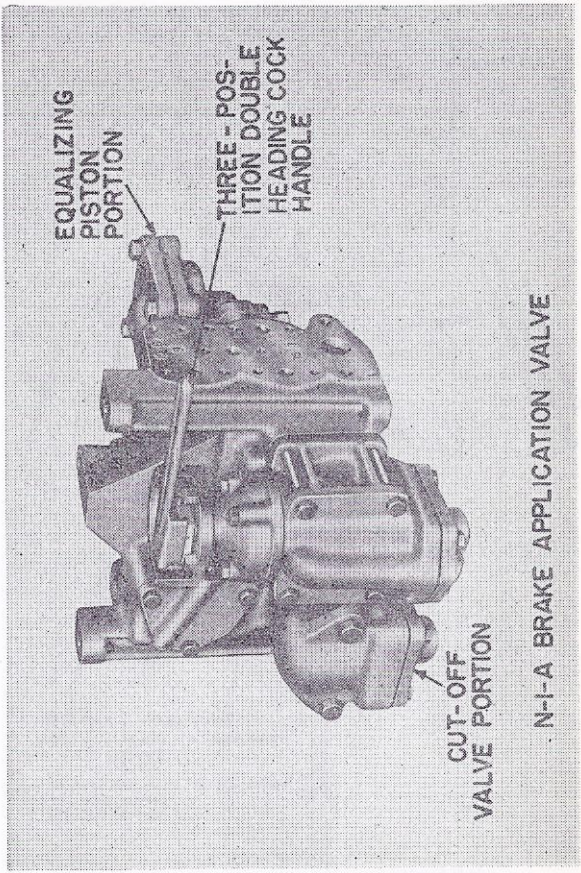
48. Q. What is the purpose of brake application valve where used?

A. To provide means for applying the automatic brake in service, independent of movement of the brake valve handle during train stop applications.

49. Q. Why must engineman know that various valves and cutout cocks of brake valve and control valve are in the proper position?

A. In order that he may know that various valvular parts of the air brake equipment will operate as intended.

50. Q. What is the purpose of the cutout cock on the Independent Brake Valve of D-22-L brake equipment?

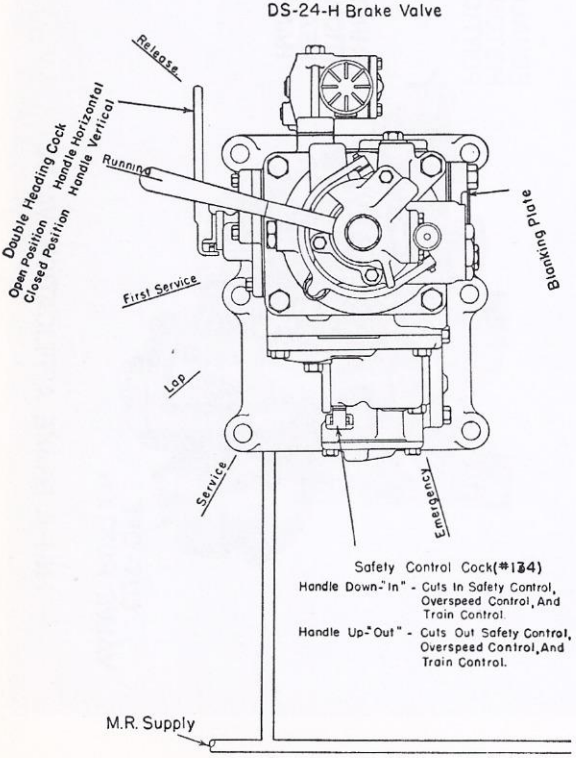


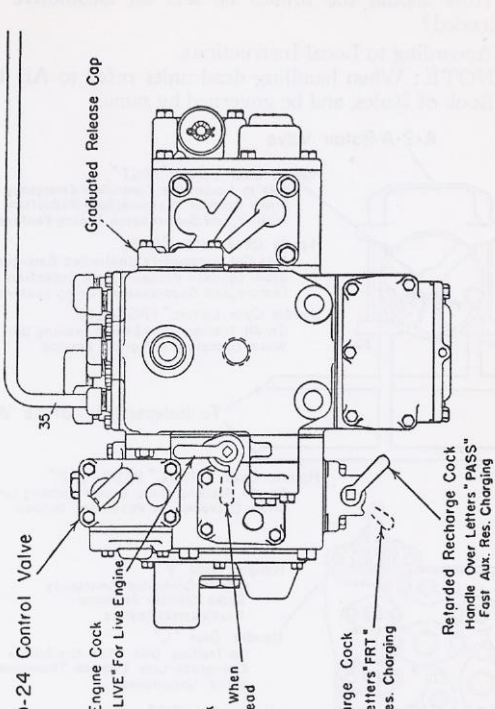
N-1-A BRAKE APPLICATION VALVE

A. To cut out the Independent brake on trailing "A" units.

51. Q. Can emergency brake application be obtained from the automatic brake valve with the double-heading cock closed?

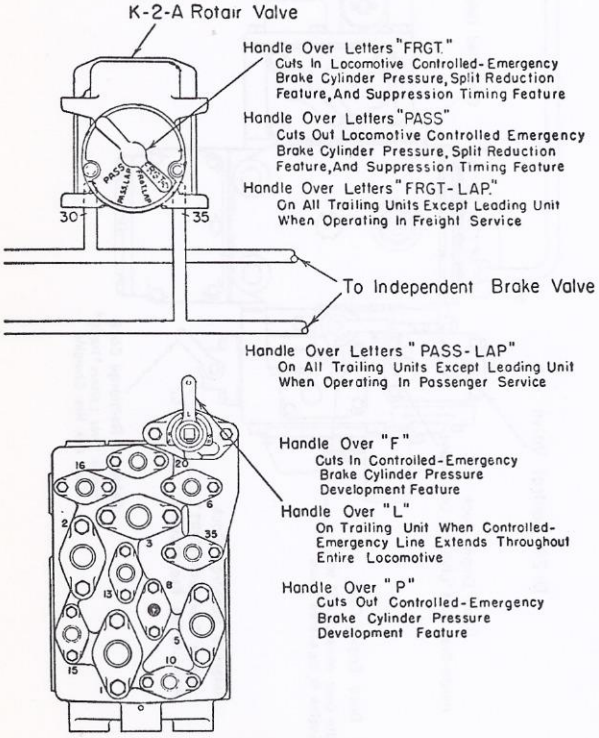
A. Yes, on 8-EL, D-22-L and D-24 equipment, and on other equipment to which the emergency relay valve has been applied.




Graduated Release Cap
35
D-24 Control Valve
Dead Engine Cock
Handle Over Word "LIVE" For Live Engine
Dead Engine Cock
Handle Over Word "DEAD" When
Engine Is Operated Dead
Retarded Recharge Cock
Handle Over Letters "FRT"
Restricts Aux. Res. Charging
Retarded Recharge Cock
Handle Over Letters "PASS"
Fast Aux. Res. Charging

52. Q. How should the brakes be left on locomotive unattended?

A. According to Local Instructions.
NOTE: When handling dead units refer to Air Brake Book of Rules, and be governed by same.



View Of Pipe Bracket For Control Valves Showing Controlled Emergency Cut-Out Cock (Used On "B" Units When "A" Units Are Equipped With K-2-A Rotair Valves)

SECOND SERIES

AIR BRAKES

The Relative Values of Answers in Per Cent

Question	Value	Question	Value	Question	Value
1	2	19	1	37	3
2	1	20	3	38	2
3	1	21	2	39	1
4	1	22	2	40	2
5	1	23	2	41	2
6	2	24	2	42	2
7	2	25	2	43	3
8	1	26	2	44	2
9	3	27	3	45	2
10	1	28	3	46	2
11	2	29	3	47	2
12	3	30	1	48	2
13	2	31	1	49	2
14	2	32	3	50	2
15	2	33	2	51	2
16	2	34	3	52	2
17	1	35	1		——
18	1	36	1	TOTAL	100

SECOND SERIES EXAMINATION
AUTOMATIC TRAIN STOP

GENERAL RAILWAY SIGNAL COMPANY'S INTERMITTENT INDUCTIVE AUTOMANUAL TYPE, UNION SWITCH AND SIGNAL COMPANY'S INTERMITTENT INDUCTIVE AUTOMATIC TRAIN STOP

NOTE: All questions and answers pertain to both U.S.&S. and G.R.S. unless otherwise specified.

PURPOSE OF PARTS

1. Q. What is the purpose of a receiver?
   A. To receive an automatic train stop impulse when passing a signal displaying any restrictive aspect in automatic train stop territory.
2. Q. What is the purpose of an inductor?
   A. To create an automatic train stop impulse in the receiver when passing a signal displaying any restrictive aspect.
3. Q. What is the purpose of the application valve?
   A. To produce an automatic train stop brake application.
4. Q. What is the purpose of forestalling whistle or gong?
   A. To inform enginemen when forestalling, that receiver is passing over inductor at signal at which forestalling is permitted.
5. Q. What is the purpose of forestalling device?
   A. To prevent an automatic train stop brake application.
6. Q. What is the purpose of forestalling reservoir?
   A. *G.R.S.*—Does not apply to G.R.S.
   U.S.&S.—To limit the time of forestalling.
7. Q. What is the purpose of train stop relay?
   A. To de-energize E.P. valve.
8. Q. What is the purpose of E.P. valve?
   A. To operate application valve.

9. Q. What is the purpose of main switch?
   A. *G.R.S.*—Has two switches.
   U.S.&S.—To cut in or out the electric current for automatic train stop circuits.

10. Q. What is the purpose of double-heading cock?
   A. To cut out operation of automatic train stop device and service application of automatic brake valve on all but leading unit.

11. Q. What is the purpose of reset device?
   A. A means provided for re-energizing E.P. valve and returning application valve to running position so that engineman can release brakes after an automatic train stop brake application.

12. Q. What is the purpose of automatic train stop check light?
   A. Lights when automatic train stop brake application is received. Goes out when reset is obtained.

13. Q. How does application valve bring about a brake application?
   A. Application valve moves to application position and vents brake pipe air to atmosphere.

14. Q. What is the purpose of forestalling circuit controller?
   A. *G.R.S.*—Does not apply to G.R.S.
   U.S.&S.—To control automatic train stop circuits when forestalling.

15. Q. When is reset device used?
   A. After an automatic train stop brake application and train has stopped.

16. Q. What must be the position of main switch handle when automatic train stop device is in use?
   A. *G.R.S.*—Both switches must be closed.
   U.S.&S.—In line with pipe.

17. Q. What is provided whereby operation of automatic train stop may be cut out, and where is it located?

A. A cutout cock located adjacent to E.P. valve, or safety control cut out cock.

18. Q. When a locomotive is used as a pusher, what must be done to cut out operation of automatic train stop on that locomotive?

A. Double-heading cock must be closed, or place 3-way cock in dead position.

19. Q. When one of the locomotives of a double-header, or when a pusher locomotive is cutoff, what must engineman do on the locomotives having double-heading cocks closed?

A. Reset automatic train stop device and open double-heading cock, or place 3-way cock in lead position.

20. Q. When one or more than one locomotive is used, is emergency position of automatic brake available at all times, on all locomotives, to manually apply brakes?

A. Yes.

21. Q. How can emergency application be obtained on other than the locomotive handling the train brakes?

A. By placing automatic brake valve in emergency position.

ROAD OPERATION:

22. Q. May an automatic train stop brake application be forestalled?

A. Yes, if the signal has been observed and is being obeyed.

23. Q. How can an automatic train stop brake application be forestalled?

A. By holding forestalling lever in full forestalling position until receiver has passed over inductor and the whistle or gong has stopped sounding, then return lever to normal position.

SECOND SERIES EXAMINATION
AUTOMATIC TRAIN STOP

24. Q. When forestalling, how does engineman know that an automatic train stop impulse is being received?
    A. By the sounding of the forestalling whistle or gong.

25. Q. How does engineman know that forestalling action has been completed?
    A. Forestalling whistle or gong stops sounding.

26. Q. When will engineman be permitted to forestall?
    A. When operating rules are being complied with, passing over inductor at signal, giving indication at which forestalling is permitted. When passing over an inductor when pushing cars or making a movement against current of traffic.

27. Q. Will an automatic train stop brake application occur when forestalling lever is held continuously in forestalling position for more than 15 seconds?
    A. *G.R.S.*—Yes.
    U.S.&S.—Yes, if held more than 15 seconds before receiver has passed over inductor, brakes will apply at signal, giving indication at which forestalling is permitted.

28. Q. If automatic train stop brake application occurs due to holding forestalling lever in the forestalling position beyond the time limit, how would you recover? (G.R.S. only)
    A. Return forestalling lever to normal position, place throttle in idle position, automatic brake valve in lap position, then wait for PC light to go out. Release brakes in usual manner.

    NOTE: Locomotives equipped with actuator, brake valve will have to be relatched in service position, then to lap position before release of brakes.

29. Q. Where is train stop relay located?
    A. In nose of engine or in steam generator compartment.

SECOND SERIES EXAMINATION

AUTOMATIC TRAIN STOP

The Relative Values of Answers in Per Cent

Question	Value	Question	Value	Question	Value
1	3	11	3	21	5
2	3	12	3	22	3
3	3	13	3	23	4
4	4	14	3	24	3
5	3	15	3	25	3
6	3	16	3	26	4
7	3	17	5	27	3
8	3	18	3	28	5
9	3	19	3	29	3
10	5	20	5		
				TOTAL	100

SECOND SERIES EXAMINATION
TROUBLE SHOOTING—STEAM GENERATORS
(VAPOR CLARKSON)

1. Q. What is the first step in locating trouble on the Vapor Clarkson Steam Generator?
   A. Look at steam generator control panel to see if the lights are lighted.
2. Q. What should be done if lights are out?
   A. Reset main circuit breaker or replace main fuses as needed.
3. Q. What are other causes of steam generator shut down?
   A. Loss of Water or fuel supply—hot water in supply tank.

   Fuses blown.

   Overload relay tripped.

   Stack switch out.

   Steam temperature limit control switch tripped (OK-4740).

   Loss of atomizing air.

   Loose or broken belts or flexible coupling.

   Coil blowdown opened or poor electric contact on coil blowdown switch.

   No spark at electrodes.

   Plugged atomizing nozzle.
4. Q. What should be looked for in case of loss of water pressure?
   A. Check water supply tank.
   See if water pump is operating and try test valve for air.

   Check to see if valve in suction line is open.

   Check to see if water treatment tank cover is on tight.

   Check suction line strainer to see if clogged.

5. Q. What should be done if supply water is too hot?
   A. See that all steam heat valves to water tank are closed and add cold water as soon as convenient.
6. Q. What fuses or circuit breaker could cause a failure on steam generators?
   A. In the control and ignition circuits, test and replace if necessary.
7. Q. What would cause overload relay to trip and what should be done?
   A. Any overload on the motor circuit will cause relay to trip. This relay should be allowed to cool for a few seconds before resetting.
8. Q. What can be done to operate steam generator, when stack Switch trips?
   A. In most cases difficulty of this nature occurs in the high fire position. By closing the Water By-Pass Regulator shut-off valve No. 19 and lowering the firing position, by opening slightly the Manual Metering Valve No. 8, Stack Switch reset button will stay in and steam generator will operate. If reset button does not stay in Metering Valve No. 8 must be opened wider, reducing further the operating temperature.
9. Q. What should be done if steam temperature limit control switch trips, on units so equipped?
   A. Blowdown through coil blowdown. Reset switch by pushing button and start steam generator in the usual manner.
10. Q. What should be done in case of loss of atomizing air?
    A. Check to see if valve in line is open, and check pressure which should be 60 to 80 lbs.
    On ABDRK-4516 type boilers pressure should be 30 to 35 lbs.
11. Q. What should be done if belts or flexible coupling is broken?

A. Report same in log book and on arrival at terminal.

12. Q. What should be done if coil blowdown is open or poor electric contact on coil blowdown switch?

A. Be sure coil blowdown valve is closed and if bell continues to ring it might be necessary to wedge coil blowdown button up in place to effect proper electrical contact as steam generator cannot be started until this contact is made.

13. Q. What should be done if there is no spark at electrodes?

A. Check wiring for ground or loose connections. Check ignition fuses or circuit breakers.

14. Q. What should be done if atomizing nozzle is plugged?

A. Enter in log book and report on arrival at terminal.

15. Q. What is the proper way to shut down the steam generator?

A. Close the stop valve and remote control train line shut-off valve. Set the water by-pass regulator to maximum output. When the generator steam pressure gauge registers 250 lbs. turn the control switch to "off." Open the coil blowdown valve. When the generator pressure drops to 100 lbs. close the valve. Open the separator blowdown valve and blow down the steam separator with the remaining pressure. Fill the coils with water according to the previous instructions with the exception that it will be found advanagetous to fill a hot steam generator with the separator blowdown valve latched open, thereby purging the coils while also eliminating the discharge of obnoxious steam within the compartment. Open the main switch.

16. Q. What would you do if one steam generator becomes inoperative enroute in freezing weather?

A. If a locomotive with a multiple installation does not have all its steam generators in operation, open the layover connection shut-off valve and the inlet valve

to the radiation on idle steam generators. Also open steam valve to water supply tank.

NOTE: If no source of steam available, drain steam generator by opening coil blowdown valve and steam separator blowdown valve, drain water pump and open all drain cocks in valves and piping.

17. Q. How would you determine a defective water by-pass valve and how would you overcome this?

A. Try closing the water inlet valve to the water by-pass regulator. If burner starts at once, this is an indication that the water by-pass regular is inoperative. To set and manually regulate the steam train line pressure, open and operate the manual water by-pass valve (8).

ELESCO STEAM GENERATOR

18. Q. What is the first step in locating trouble on steam generator?

A. Look at control panel to see if instrument lights are burning. If lights are not burning, reset main breaker properly or (where main fuse is used instead of main breaker, test main fuse and replace if needed).

19. Q. What would you do if steam generator shut down but alarm does not ring?

A. A failure of this type will be indicated by a drop in trainline pressure on gauge in cab and at steam generator, red and green lights out on steam generator control panel, also water gauge and pressure gauge light out, no fuel pressure.

Possible causes and correction: Steam generator power line fuses blown or circuit breaker tripped; replace fuses or reset circuit breaker. Steam generator power line may have a circuit breaker for main switch; if so, push handle all the way down to reset and then raise to the "on" position.

20. Q. What would you do if steam generator shuts down, alarm bell rings?

A. Red, green and water pressure gauge lights out, no fuel pressure, blown fuse or fuses in motor control cabinet, test the 10 and 30 ampere fuses, replace if necessary. Also overload relay in motor control cabinet has tripped, reset.

NOTE: Whenever a steam generator shuts down, observe fuel pressure gauge if the red hand which indicates fuel pump pressure shows pressure, the operating motor is running and therefore the fuses, circuit breakers and overload relays can be eliminated as a source of trouble.

21. Q. What would you do if steam generator shut down, alarm rings?

A. Observations at generator, red light only out, no water in water glass, gauge hands on steam pressure gauge less than 15-lb. apart. Causes, feed pump racing, open air vent valve on top head of water end of feed pump until pump works smoothly, then close valve, if feed pump is stopped close steam valve to feed pump, see if pump will operate on air, if so, fill water glass full of water. Differential gauge hands will be about 30 lbs. apart and generator will fire. Close air valve and open steam valve to feed pump, if feed pump will not yet run on steam the feedwater regulator is stuck. Shut down steam generator and protect from freezing.

22. Q. What would you do if steam generator shuts down, alarm bell rings?

A. Observations at generator.
Red light out, alarm ringing water glass surging and bubbling gauge hands on differential gauge less than 15-lb. apart, water in steam generator is foaming. Open manual blowdown valve and blowdown generator. Continue to operate feed pump until steam drops to 75 or

100 lbs. then shut down valve to feedwater pump and operate on air.

NOTE: Blowing and adding water until alarm stops ringing. Then sufficient differential pressure has been reached and steam generator will refire.

NOTE: Don't forget to shut *feedwater pump air valve* and open steam valve.

23. Q. What should be done if observations at steam generator when steam generator shuts down and alarm bell rings are as follows:

Red and green lights out on steam generator control panel and fuel pump pressure is up?

Start button kicked out?

A. Put burner control switch in starting position, push start button. Green light will come on. Put burner control switch in running position. Generator will fire. For dirty fireye sight glasses—put burner control switch in starting position, clean sight glasses with clean rag, push start button, green light will come on, put burner control switch in running position, generator should fire.

Caution: Fireye glass frame may be hot.

24. Q. How would you recover from loose electrode wire or stuck air damper?

A. Put control switch in starting position. Check electrode wires at burner head and transformer. Also see that damper piston operating air damper is in full closed or down position. Push start button, green light will come on. Put control switch in running position generator should fire.

NOTE: Trouble from loose electrodes or electrode wires will only happen when generator is cycling. If generator was operating under load when shut down occurred, this item can be ignored. If checking the

above does not allow generator to fire, blow it down and protect from freezing.

Caution: Do not check electrodes and wiring until control switches are in "off" position.

All gauge hands are colored and are marked to show pressure and designation. Loss of differential pressure will cause steam generator to shut down and have to be restarted.

ALL STEAM GENERATORS

25. Q. How would you operate remote control on steam generators?

A. Make sure master switch is on at fireman's control panel and separator blowdown button should be pushed 5 seconds every 20 minutes.

26. Q. How would you shut off steam to train by remote control?

A. By lifting cover on train line shut off button and pushing button until steam pressure on gauge starts to drop.

TRAIN LINE STOP VALVE ON ALL STEAM GENERATORS ON TOP OF STEAM SEPARATOR MUST BE CLOSED MANUALLY BEFORE A CUT IS MADE IN THE TRAIN LINE.

27. Q. How would you reset the remote control steam shut-off solenoid valve?

A. By pulling lever down to latch position. This must be done before the manual stop valve is opened.

28. Q. How is an Elesco Steam Generator placed on Automatic Standby Control?

A. Operating Instructions:

1. START STEAM GENERATOR IN USUAL MANNER WITH THE STANDBY SELEC-

TOR SWITCH IN THE "OFF" POSITION AND BRING STEAM GENERATOR UP TO FULL OPERATING STEAM PRESSURE.

2. WITH THE CONTROL SWITCH IN "RUNNING POSITION" TURN THE STANDBY SELECTOR SWITCH TO THE "ON" POSITION. (With standby switch "on" the burner cycles on when the steam pressure falls to 100 lbs. and cycles "off" when steam pressure reaches 295 lbs. The steam generator motor runs at full speed when burner is on and at reduced speed when burner is off.)

3. OPEN THE STANDBY CONTROL HEATER VALVE WIDE. (When heating of steam generator supply water tank is not required this valve need not be opened.)

NOTE: If feedwater suction temperature falls below 40 degrees F. the alarm temperature switch will sound the steam generator alarm. To determine whether alarm is due to a steam generator shutdown, or due to low water temperature, push "STOP" button, and if alarm continues to sound it indicates the alarm is sounding due to low water temperature.

When a road switcher is operating in freight service with the steam generator in standby operation, the trainline end valves of the locomotive are open and no steam is fed to the trainline. In the event of failure of either the tank water heating temperature switch or the tank water heating solenoid valve, the steam generator alarm would sound when the tank water temperature falls to 40 degrees F. If a failure of this type occurred it would be necessary to close the end valves on the locomotive, operate the steam generator with the standby selector switch in the "off" position, open the trainline steam shutoff valve to carry steam pressure on the trainline, and open the steam generator water

supply tank heater valve which obtains its supply of steam from the trainline.

29. Q. How is an OK-4740 Series Vapor-Clarkson Steam Generator placed on Automatic Standby Control?

A. Standy operation:

1. Follow normal FILL and START procedures outlined above.
2. Set water by-pass regular—111 for maximum pressure.
3. Close stop and check valve—15.
4. Open return line valve (standby)—56 and make sure steam admission valve to radiation—10 is open.
5. Turn control switch—102 to STANDBY.

SECOND SERIES EXAMINATION

STEAM GENERATORS

The Relative Values of Answers in Per Cent

Question	Value	Question	Value	Question	Value
1 Vapor	3	11	3	21	3
2	3	12	3	22	3
3	4	13	3	23	4
4	4	14	3	24	4
5	4	15	5	25	4
6	3	16	5	26	3
7	3	17	5	27	3
8	4	18 Elesco	3	28	3
9	3	19	3	29	3
10	3	20	3		
				TOTAL	100

SECOND SERIES — RAIL DIESEL CARS
MECHANICAL AND AIR BRAKE

1. Q. What are the duties of an engineman before attempting to move a Diesel rail car?

   A. 1. Be sure that both engines are running and that the run button and isolation switches on both engines are in RUN position.
   2. Know that the air brake equipment at the non-operating end is changed to non-operating position with brake valve handle removed, and double-heading cock on the non-operating end closed.
   3. Know that the double-heading cock at the operating end and the N-1-A application valve are cut in, and the brake pipe angle cocks on both ends of the car are closed.
   4. Know that the train stop circuit breaker is in closed position and the train stop reset.
   5. Observe air gauges to insure having required air pressures and make the necessary air brake tests and release hand brakes.

2. Q. How should car be moved and what is the correct method of handling the throttle?

   A. 1. Move reverser in direction desired. Move throttle from (OFF) position to #1 position and wait until the transmission clutches engage, depress safety control pedal, then release brakes. Car will accelerate from 0—MPH to 20-25 MPH, depending on the grade.
   2. For greater speeds move throttle lever from #1 to #2, then #3 and finally to #4 as required, pausing in each position while accelerating before advancing.

3. Q. What would occur if throttle was accidently moved to "OFF" position with car moving?

   A. The transmission clutches would disengage and if throttle was moved to #1 position it would cause clutches to re-engage which would place undue stresses and cause possible damage to engines and transmissions

due to the engine and car wheel speeds not being synchronized when clutches re-engage.

4. Q. What should be done if engines run but car does not move?

   A. 1. Shut off throttle and apply air brakes to not less than 35 lbs. brake cylinder pressure. Reverser in neutral and apply hand brake before leaving operating end.
   2. See that RUN BUTTONS are in run position when equipped.
   3. Note that isolation switches are in NORMAL position in both regulator locker on both ends of the car.
   4. Hand brake may not have been released.
   5. Check controller fuse, check engine negative control fuse, renew fuse if necessary.
   6. Check for too much sand on the rails.

5. Q. If all fuses (circuit breakers if so equipped) and switches are found in good condition, and no other defects noted, what may be the cause?

   A. 1. One engine may be mechanically stuck in reverse clutch position.

   TO TEST: Isolate the engine nearest to the operating cab by moving the isolation switch to ISOLATE position; release brakes, move throttle to #1 position. If car moves backwards with reverse lever in forward position the clutch on rear engine is mechanically stuck in forward position causing the car to move in opposite direction.

6. Q. Is it possible for either engine to become mechanically stuck in opposite position and how should test be made?

   A. Yes. Test should be made as stated above.

7. Q. What actions should be taken if it is found that a clutch is mechanically stuck?

   A. 1. Shut down engine, if drive wheels on truck affected

move freely, indicating that clutch has released. PROCEED with one engine and report defect on arrival at terminal.

2. If clutch fails to release after engine has been shut down, it will be necessary to disconnect the drive shaft by removing the bolts in the drive shaft by removing the bolts in the drive shaft flange at the axle gear box, and to protect the drive shaft spline by pushing it in the drive about two inches, after which secure the loose end of the drive shaft to the safety hanger. Proceed with one engine and report on arrival.
3. WARNING: DO NOT ATTEMPT TO CRANK ENGINE WITH DRIVE SHAFT DISCONNECTED.

8. Q. What action must be taken if one of the axle gear units has seized?

   A. If gear unit is suspected to be faulty. DO NOT MOVE CAR UNTIL PROPER AUTHORITY IS OBTAINED.

SECOND SERIES — RAIL DIESEL CARS AIR BRAKE

1. Q. What should be done if, when making a station stop, the Rolokron picks up repeatedly?

   A. If rail conditions are very bad, prepare to slow down well in advance of the station stop, using sand to within one car length of stop and use lower brake cylinder pressure.

2. Q. What cocks must always be open for single car operation?

   A. Main reservoir cutout cock, air supply cock for horns, brake cylinder cutout cocks for both trucks, safety control cutout cocks, cutout cocks in branch pipe from emergency (conductor's) valve pipe to brake pipe at brake valve, double-heading cock at N-1-A brake application valve, K-1 brake application valve cutout

cock, double-heading cock beneath the brake valve must be open on the operating end and closed on the non-operating end.

3. Q. What cocks must be closed for single car operation?
   A. Main reservoir drain cocks, brake pipe angle cocks, both ends, main reservoir equalizing pipe end cocks, both ends.

4. Q. What cocks must be open for multiple unit operation?
   A. Brake cylinders, main reservoirs, horns, safety control (foot pedal), conductor's valves and cocks between units.

   NOTE: Conductor's emergency valve is connected to brake pipe near brake valve.

5. Q. What cocks must be closed for multiple unit operation?
   A. Main reservoir drain cocks (all units), brake pipe angle cocks and main reservoir equalizing pipe end cock at end of train, the double-heading cock beneath all brake valves of non-operating stations, and all double-heading cocks at N-1-A brake application valves of all trailing units.

6. Q. How should car be conditioned to be hauled dead in train?
   A. Place both automatic brake valve handles in "Handle Off" position and remove. The following cocks must be known to be open:

   Brake cylinder cutout cocks for both trucks.

   Brake pipe and cocks where hose is coupled to adjacent car.

   The following cocks must be closed:

   Double-heading cock beneath brake valve at both ends of car and at N-1-A brake application valve.

   Cutout cocks beneath the brake valve in branch pipe from emergency (conductor's valves) at each end of car.

D-22-AR valve should be in direct release if handled in freight service and graduated release if handled in passenger train.

Hand brake released.

NOTE: Where signal line or hose are used on RDC cars—do not confuse reservoir equalizing hose with signal line hose on adjacent passenger car. This hose must not be coupled but should be hung in dummy coupling.

7. Q. What cocks must be open when handling a single unit as a coach in a passenger train, or dead in a freight train?

   A. Brake cylinder cutout cocks for both trucks, brake pipe angle cock where hose is coupled to adjacent car.

8. Q. Where are the safety control cutout cocks located on the RDC 1 (coach) and RDC 2 (coach-baggage) type cars?

   A. 1. On the RDC 1 type it is located directly below the safety control pedal underneath the car.
   2. On the RDC 2 type it is located underneath the car on the brake pipe side adjacent to the center sill under vestibule.

9. Q. Name the hoses on each end of the R.D.C. cars.

   A. Brake pipe, signal line when used, and main reservoir equalizing hose.

10. Q. Does the closing of the safety control cock nullify train stop application of the brakes?

    A. No.

11. Q. If train stop failure occurs, how may its function be nullified?

    A. By closing the cock on application portion of the N-1-A application valve.

12. Q. Does the closing of this cock nullify the safety feature as well as the train stop?

    A. No.

SECOND SERIES

R. D. C. MECHANICAL

The Relative Values of Answers in Per Cent

Question	Value	Question	Value	Question	Value
1	5	4	10	7	3
2	5	5	3	8	6
3	5	6	3		

SECOND SERIES

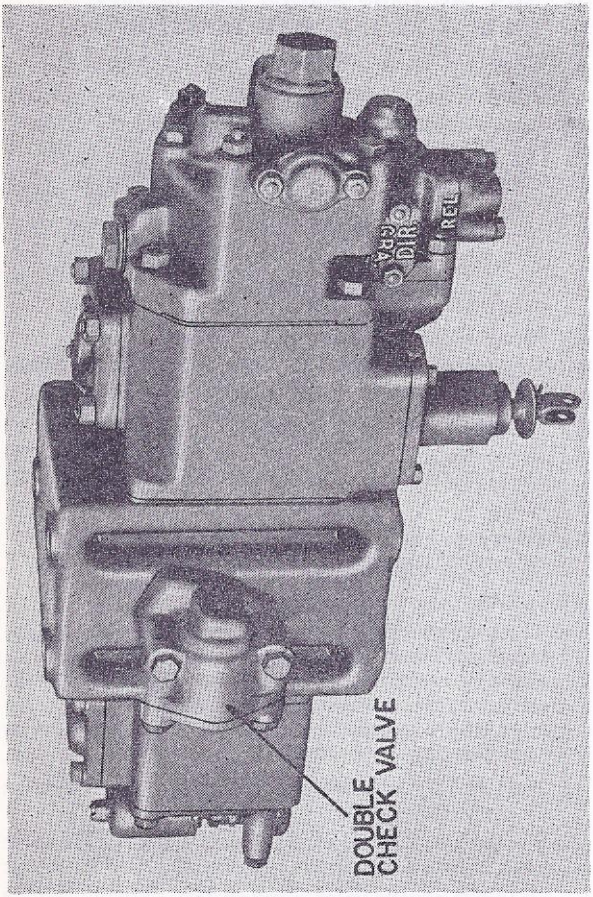
AIR BRAKE — R. D. C.

Question	Value	Question	Value	Question	Value
1	5	6	5	11	5
2	5	7	5	12	5
3	5	8	5		—
4	5	9	5		100
5	5	10	5		

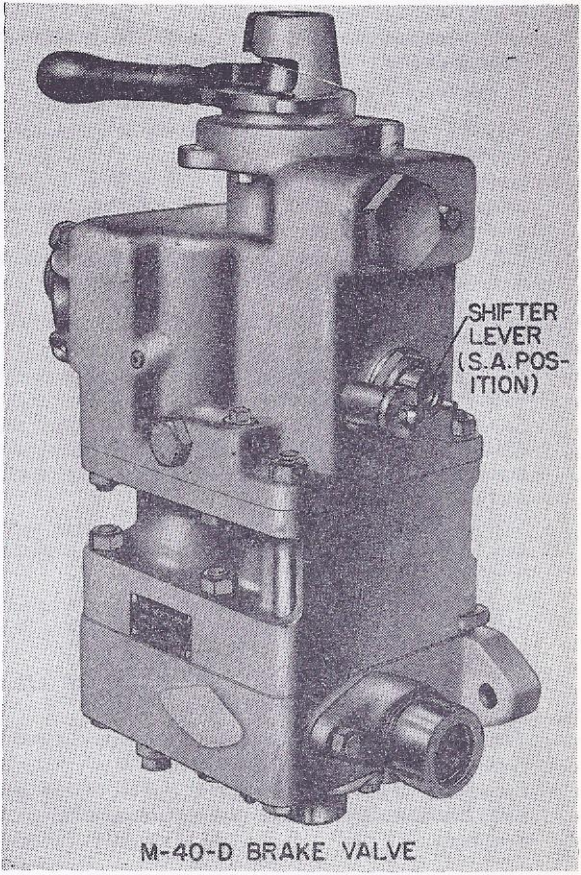
SECOND SERIES

QUESTIONS AND ANSWERS PECULIAR TO NEW MU CARS SERIES 4500 to 4599 (NEW YORK ELECTRIC TERRITORY)

1. Q. What type brake equipment is used on these cars?
   A. D-22 MUE.
2. Q. Name different parts of brake equipment.
   A. (1) M-40-D brake valve, (1) equalizing piston and reservoir, (2) air gauges, (1) double heading cock, (1) whistle valve, on each end of car; D-22-BR control valve and double check valve, master controller, 21-B magnet valve, #15 double check, compressor governor, F-6 feed valve, signal reducing valve, air compressor and several reservoirs.
3. Q. What are the features of this equipment?
   A. Automatic Pneumatic and Electro Pneumatic brake features with control station at each end of car.
4. Q. How are these features separated?
   A. By double throw check valve located on the D-22 BR control valve bracket, and shifter lever on each brake valve.
5. Q. What type brake valves used?
   A. M-40-D, one installed at each end of car.
6. Q. How do these brake valves operate?
   A. There are two distinct brake valves in one housing operated with one handle over a common quadrant. A manually operated shifter lever conditions the brake valve to either conventional automatic brake operation or to electro pneumatic straight air brake operation as determined by its position.
7. Q. How does the manually operated shifter lever condition the brake valve?
   A. Shifter lever located on *right hand side* of brake valve when in forward position (letters on top AU) automatic operation. Shifter lever when in *rear position* (letters



FRONT VIEW OF THE D-22-BR CONTROL VALUE



M-40-D BRAKE VALVE

on top SA) electro pneumatic straight air is in operation position.

8. Q. What position must brake valve handle be in when moving shifter lever?

   A. In release or running position.

9. Q. Name positions on brake valve, automatic and electro pneumatic operation?

   A. Automatic operation; there are (4 positions) release or running, lap (which is also handle-off position) service and emergency.

   Electro pneumatic; there are (3 positions) release or running, application position and emergency.

10. Q. What are the different positions used for (automatic and electro pneumatic)?

    A. *AUTOMATIC, RELEASE OR RUNNING* to keep train brake release and brake pipe charged.

    Lap Position—all ports are closed, this position is used while holding the brakes applied after a service application until it is desired to make a further brake pipe reduction or to release.

    Service Position—this position gives a gradual reduction of brake pipe pressure to cause a service application.

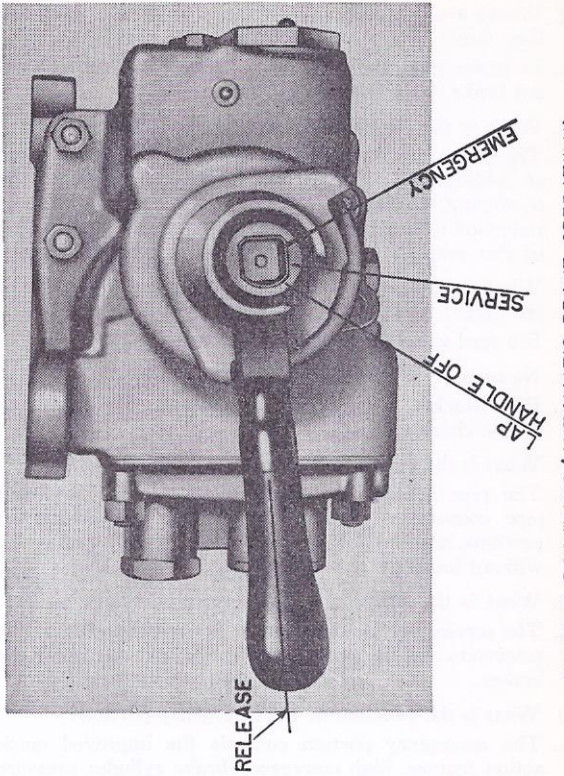
    Emergency Position—this position is used when the most prompt and heavy application of the brakes is required.

    ELECTRO PNEUMATIC, RELEASE OR RUNNING to keep train brake released.

    Application Position—is the application zone for service application of the electro pneumatic brake.

    Emergency Position— (extreme right), opens pilot valve making direct brake pipe communication to atmosphere.

11. Q. How is electro-pneumatic pressure controlled, what pressure is it set for?



A. By a self lapping portion on brake valve and is set for 65 pounds maximum.

12. Q. Where is equalizing piston located and what is it used for?

A. Under brake valve on pipe bracket and used to control automatic reduction.

13. Q. Where are double heading cocks located and when are they used?

    A. In brake pipe under brake valve and are used to cut out brake valve from brake pipe.

14. Q. What is the purpose of the equalizing reservoir?

    A. The purpose of the equalizing reservoir is to provide an additional volume of air above the piston in the equalizing discharge valve so as to insure a gradual reduction of brake pipe pressure and a gradual stopping of this reduction regardless of the length of the train.

15. Q. What controls the brake pipe pressure and what is it set for?

    A. F-6 feed valve and is set for 90 lbs.

16. Q. Name parts of the D-22 BR control valve.

    A. Pipe bracket, service portion, emergency portion and double check valve.

17. Q. What is the purpose of the pipe bracket?

    A. The pipe bracket is used as a means for permanent pipe connections, leaving the service and emergency portions, and the double check valve, readily removable without breaking pipe connections.

18. Q. What is the function of the service portion?

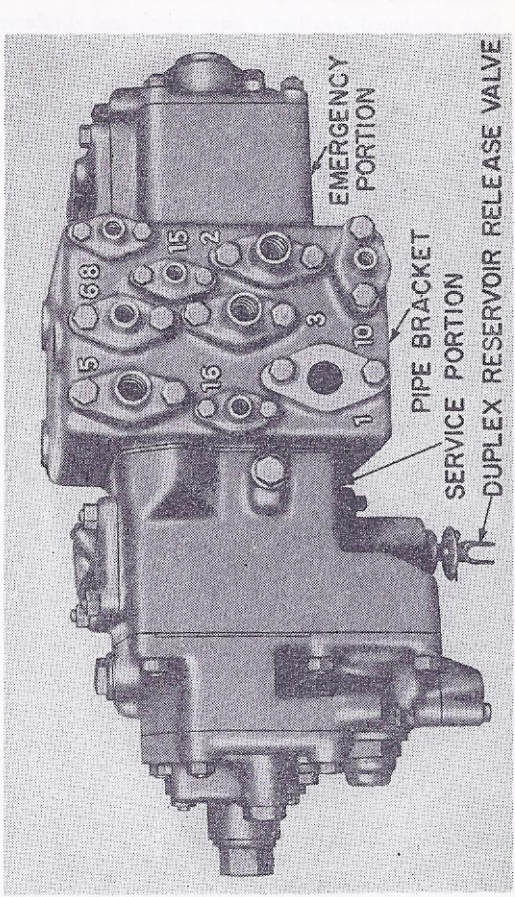
    A. The service portion controls the desired charging of the reservoirs and the service application and release of the brakes.

19. Q. What is the function of the emergency portion?

    A. The emergency portion controls the improved quick action feature, high emergency brake cylinder pressure and the accelerated emergency release function.

20. Q. What is the purpose of the double check valve?

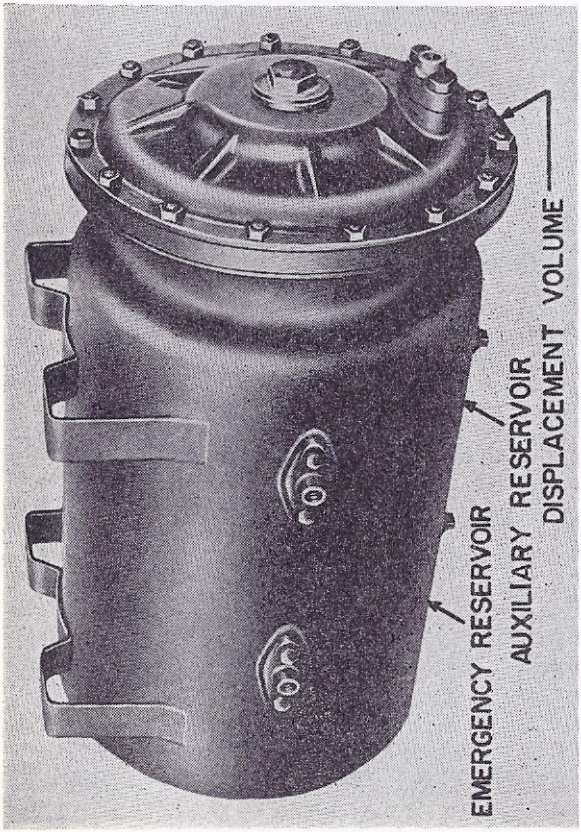
    A. The double check valve portion, consists of a double throw check valve, which separates the electro-pneumatic and automatic brake functions, but permits control of the relay valve by either.



REAR VIEW OF THE D-22-BR CONTROL VALVE

21. Q. What is the three compartment reservoir?

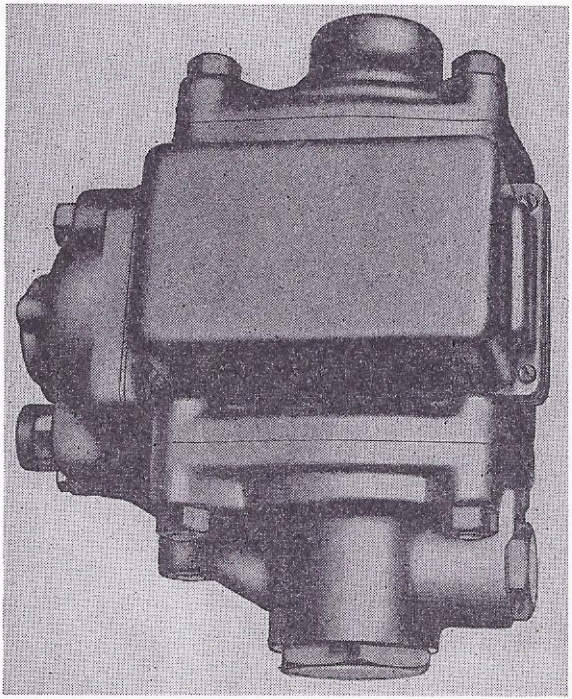
A. One combined auxiliary, emergency and displacement reservoir is used in the automatic brake system as a means for saving space and simplifying applications.



COMBINED AUXILIARY, EMERGENCY AND DISPLACEMENT RESERVOIR

22. Q. What is the purpose of the B-3 relay valve?

A. The B-3 relay is used to admit air to and exhaust air from the brake cylinder in response to air pressure development in the displacement reservoir by the control valve during automatic brake application, or in response to development of straight air pipe pressure during electro pneumatic straight air brake application. The relay valve is of the self lapping type and takes air from the supply reservoirs for developing pressure in the brake cylinder.



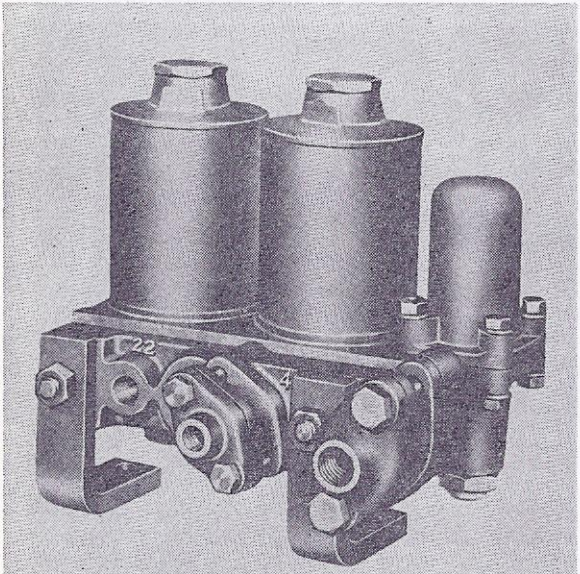
B-1 Master Controller

23. Q. What is the master controller?

A. The B-1 master controller is a double contact pneumatic switch which operates on a balance of pressure between the control pipe from the brake valve and the straight air pipe. The electrical contacts control the electro pneumatic system and exhaust air to and from the straight air pipe to govern its pressure.

24. Q. What is the purpose of 21-B magnet valve?

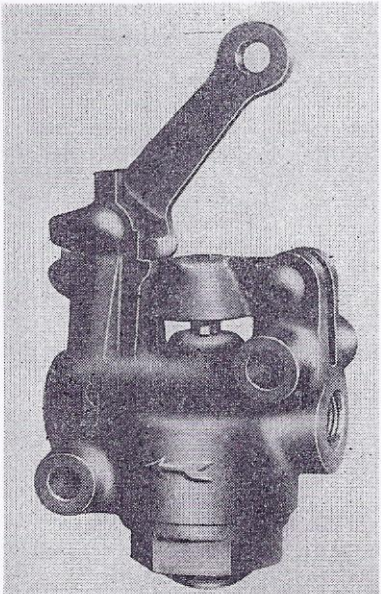
A. No. 21-B magnet valve is used to pilot the application or release of the brakes on the car during electro pneumatic operation.



21-B MAGNET VALVE AND BRACKET

25. Q. What is the ½" dead engine cock used for and where located?

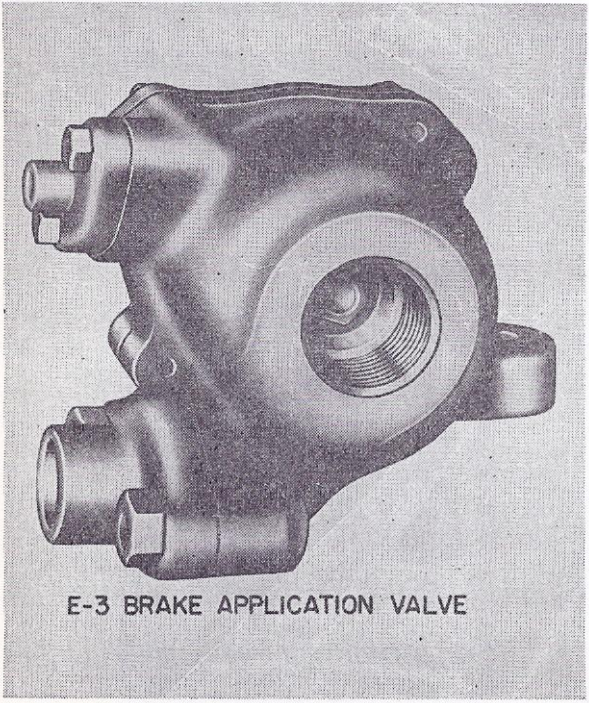
A. It is installed in the No. 6 pipe between the D-22 BR control valve and the supply reservoirs. When open it permits charging of the reservoirs from the D-22 BR control valve to provide necessary air supply when the car is handled in a conventional train with automatic brake, but when closed it prevents back flow from these reservoirs to the control valve when in normal multiple unit service and is located back of control valve near center sill.



B-3-B EMERGENCY BRAKE (CONDUCTOR'S) VALVE

26. Q. What is the No. 15 double throw check valve used for?
    A. It is installed in the No. 11 pipe connection of the two M-40-D brake valves. Its side connection is piped to the No. 11 connection of the B-1 master controller. The purpose of the No. 15 double throw check valve is to isolate the control pipe to the inoperative brake valve during electro pneumatic brake operation.

27. Q. What type governor is used?
    A. Pressure switch.



E-3 BRAKE APPLICATION VALVE

28. Q. What are the E-3 brake application valves used for?
    A. They are installed in the brake pipe; one at each end of the car. The B-3-B Emergency brake (Conductor's) valve is installed inside the car on the end of an actuating pipe leading from one of the brake application valves. These E-3 brake application valves are also piped to a pilot valve on motorman's control stand.

29. Q. What is the A-1 supply unit used for?
    A. It is used to supply air at regulated pressure for auxiliary use.

30. Q. How many air gauges are there on each end of car, what pressures are indicated on each?
    A. There are (2) 3½" Duplex air gauges installed at each control station, on one of the gauges the red hand indicates straight air pipe pressure and the white hand equalizing pipe pressure; on the other, the red hand indicates main reservoir pressure and the white hand brake cylinder pressure (Rule 1512).

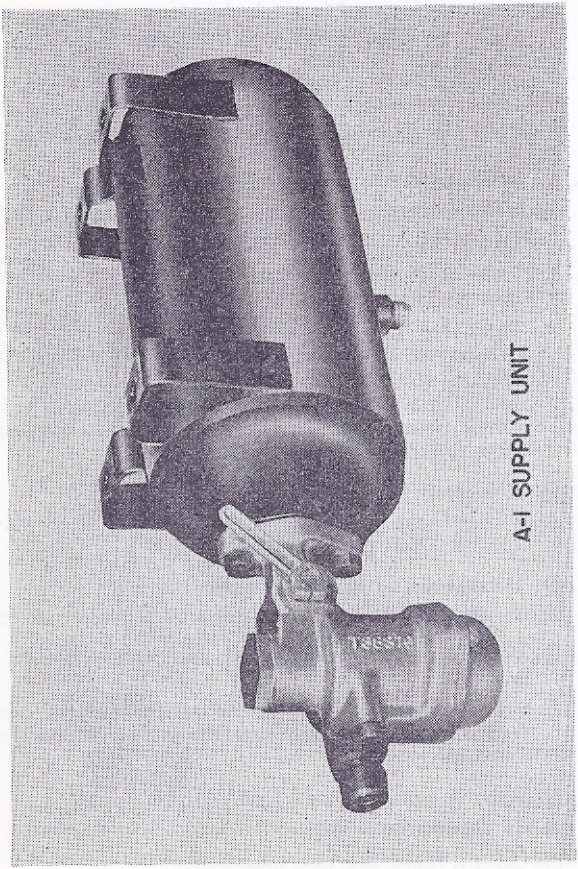
31. Q. How many air hoses on each end of car?
    A. 4 hoses—one for brake, one signal, one feed valve equalizing hose and straight air hose.

32. Q. What is the straight air hose used for?
    A. To equalize the straight air pressure between each car.

33. Q. What is controlled line hose used for (Feed valve line)?
    A. Feed valve line is used to connect the cars, allowing feed valve pressure from each car to flow to operating brake valve.

34. Q. What is signal line used for?
    A. To operate signal line.

35. Q. What is brake pipe hose used for?
    A. To operate the automatic brake.


A-1 SUPPLY UNIT

36. Q. Do you fully understand that 2 complete car to car brake tests must be made on application and release on trains equipped for Electro Pneumatic brake operation?

A. Yes.

37. Q. Do you fully understand that Car Inspector and Engineer is responsible for release of hand brake set by Engineer operation?

A. Yes.

NOTE: The following instructions, given to Engineers handling trains for Electro Pneumatic brake operation, is quoted below for benefit of Carmen and Supervision, in that the knowledge may serve a direct purpose in assisting engineer to locate a condition overlooked by him in preparaing train.

38. Q. How is Terminal Test made?

A. After completing terminal test of automatic air brake, in accordance with time table instruction and Rules for the Operation of Air Brake and Train Air Signal, and with brake system recharged to 90 lbs. air pressure, upon proper request or signal to apply brakes for test, a minimum 20 lb. Electro Pneumatic brake application must be made as indicated by brake cylinder gauge. Examination must then be made to determine whether brakes are applied on each car. When this examination has been completed, proper release signal must be given and each brake examined to see that it releases properly.

39. Q. How is running test made?

A. When operating with Electro Pneumatic brakes, a running test must be made with the Electro Pneumatic brake as soon as speed of train permits on leaving initial terminal or any point after Engineman has been changed or an angle cock closed, except for cutting off rear cars, or any electrical circuit cable disconnected between cars. Such tests should be made with not less than 20 lbs. brake cylinder pressure.

40. Q. How do you brake for slow-down or station stop?

A. The initial application should not exceed 10 lbs. brake cylinder pressure (this to apply shoes to wheels and control slack, etc.). Electro Pneumatic brake application, brake cylinder pressure, should be increased sufficiently to control train speed, graduating off as speed reduces and stopping with light brake cylinder pressures. After stop is completed, brake cylinder pressure should be increased sufficiently to hold train from moving.

If there is anything you do not understand about these instructions please consult the Air Brake Supervisor or Road Foreman.

41. Q. What should be watched very closely during operation?

A. That green light is lighted at all times in body of car when possible to observe it.

42. Q. How would you change ends?

A. On lead or controlling car arriving:

1. Apply hand brake.
2. Move brake valve handle to RELEASE POSITION.
3. Move shifter lever on brake valve to AUTOMATIC (A.U.) position (away from operator).
4. Make a twenty pound automatic service brake pipe reduction, (approximately 50-lb. brake cylinder pressure).
5. Close double heading cut out cock.
6. Remove brake valve handle (Handle off in LAP position).
7. Open (OFF) cab control switch (MS-46).
8. Close cut out cock between signal valve and whistle.
9. Release hand brake.
10. Open CONTROL switch (De-ion Braker) on Main Switch Panel at #2 end of car.

11. Leave brake valve handle in holder under Main Switch panel.
12. Proceed to opposite end of train.
13. Close CONTROL switch on main switch panel at #2 end of car.
14. Obtain brake valve handle from holder under main switch panel.
15. *Apply Hand Brake.*
16. Open cut-out cock between signal valve and whistle.
17. Close cab control switch.
18. Apply brake valve handle.
19. Open Double heading cut out cock.
20. Move brake valve handle to RELEASE Position.
21. Move shifter lever on brake valve to STRAIGHT AIR (S.A.) position (toward operator).
22. Release hand brake.

NOTE: *Preparing trains for service.*

When preparing train for service, Engineman passing through train must know that:

1. Shifter levers on all brake valves are in automatic (A.U.) position.
2. Control switches on all cars are open, except operating car.
3. Hand brakes are released on all except head and rear cars.
4. Cut out cock at signal whistle is closed at all whistle valves except in control (leading) vestibule.
5. Double heading cocks closed, except on leading vestibule.

Preparing cars for handling "Dead" in train

1. Place shifter lever of both brake valves in AUTOMATIC (A.U.) position.
2. Close double-heading cut out cocks under both brake valves.
3. Remove brake valve handles.
4. Close both signal whistle cut out cocks.

5. Open control switches.
6. Connect brake pipe end hose and open angle cocks.
7. Connect train air signal hose and open end cocks.
8. Open straight air pipe end cocks and hang straight air pipe hose so it cannot be damaged. Do not apply dummy couplings to straight air pipe hose when car is handled DEAD in a train.

CAUTION:

When necessary to stop on grades for reverse movement, automatic air brakes must be used.

Trains of these cars, or single cars, must never be left unattended without automatic air brake being applied in service application and a hand brake applied.

Brake valve shifter lever must not be moved in or out of straight air (S.A.) position without first applying a hand brake, when conditions are such that cars may move with brakes released.

Operation of appurtenances, including lights, compressor control switches, air conditioning controls, etc., must be in accordance with Time Table Special Instructions for other cars.

Assuming all other factors satisfactory, what would prevent release of brakes in Electro Pneumatic brake operation?

Low voltage due to dead or low batteries. (Brake system to be fully charged.)

1. Control switch (on main switch panel) in closed position on car other than that controlled and operated by Engineer.

NOTE: This must be definitely established. Otherwise, brake cylinder pressure of approximately #30 would be obtained throughout the train, and could not be released until it is known that control switches are in open position on all cars other than that controlled and operated by engineer.

2. Defective master controller.

NOTE: To determine if master controller defective.

1. (a) Have engineer open control switch on his operating car, with control switch open, if brakes release, notify Engineer to operate train with automatic brake.

   (b) Open straight air cock at head end of control car to vent air that may build up in straight air pipe due to leakage of auxiliary reservoir air through 21-B magnet valve. Leave straight air cock open.

   (c) Notify terminating point that lead or operating car (give number) has defective master controller.

2. If brakes fail to release with control switch closed, and through manipulation of brake valve handle, with shifter lever either in S.A. (straight air) or A.U. (automatic position) it indicates defective electric circuit other than master controller, what action should be taken?

   Car should be removed as the lead or operating car and matter referred to Operating and Electric Equipment Departments for further handling.

NOTE: While instructions on Page #181, "Preparing Trains for Service" apply to Engineer, and provide for shifter levers to be in A.U. (automatic position) on all cars, except operating cars, the fact that this is standard procedure to be followed by engineer, the matter of further check by Carmen will be based on instructions from supervisory foremen.

SECOND SERIES

MU 4500 to 4599
THE NEW YORK ELECTRIC TERRITORY

The Relative Values of Answers in Per Cent

Question	Value	Question	Value	Question	Value
1	3	15	2	29	2
2	2	16	3	30	2
3	2	17	2	31	2
4	2	18	2	32	2
5	6	19	2	33	2
6	2	20	4	34	2
7	2	21	2	35	2
8	2	22	2	36	2
9	2	23	2	37	2
10	2	24	2	38	4
11	2	25	2	39	4
12	2	26	2	40	3
13	2	27	2	41	2
14	2	28	2	42	5
				TOTAL	100

THIRD SERIES OF QUESTIONS AND ANSWERS

THIRD SERIES—DIESEL ELECTRIC LOCOMOTIVES

1. Q. What is the prime requisite of an engineman operating a train?

   A. He must, if anything withdraws attention from constant lookout ahead, or weather conditions make observation of signals or warnings in any way doubtful, at once so regulate speed as to make train progress entirely safe.

2. Q. What are the duties of enginemen when reporting at enginehouse?

   A. Report to the engine dispatcher or foreman, compare watch with standard clock, register, fill out prescribed forms, turn them in and any other duties as may be prescribed by rule or local instruction. Examine bulletin. Sign when required.

3. Q. What are the duties of engineman when taking charge of locomotives?

   A. Read log book for report of previous trip. Inspect locomotive running gear and draft gear, see that all brake cylinders are cut in, know that there are necessary supplies such as lube oil, fuel oil, cooling water, steam generator water where required, flagging equipment, tools, fire extinguishers, extra jumper cable and air hoses. Make the necessary air brake inspection, check rotair valves, controlled emergency cocks or double heading cocks when in multiple unit operation. Check unit selector switch, if equipped, check sanders, blow out air hoses and steam line if equipped. See that air hoses are in their proper hangers. See that all engines are on the line and hand brakes released. Check air horns and bell. See that cab cards are on unit. Test signal line and whistle when used. Test train stop.

4. Q. What devices should be sealed leaving dispatching point?

   A. 1. E. P. valve cut out cock.
      2. Safety control cut out cock.

3. Speed recorder.
4. Hostler control "B" unit.
5. Ground relay knife switch.
6. Temperature control on Alco and Baldwin.
7. Unit selector switch on EMD and FM.
8. Such other devices as required.
9. Control air pressure reducing valves.
10. Surge relay or impulse relay if so equipped.

5. Q. Name some of the reasons that the locomotive will not move with the engine running and the throttle open.

A. The locomotive will not move if the following conditions exist:

(a) Generator field or exciter breaker or switch in off position.
(b) Control air pressure low.
(c) Starting contactors stuck.
(d) Hand brake or air applied.
(e) Fuses blown—such as control, battery field, etc.
(f) Auxiliary generator exciter set drive belt slipping.
(g) Ground relay tripped.
(h) Throttle switch not closed.
(i) Traction motor cut out switches open.
(j) Interlocks in power control circuit not functioning.
(k) Fingers on controller not making good contact.
(l) PC switch tripped.
(m) Reverse lever in neutral.

6. Q. How would you proceed to move a light locomotive?

A. Have rotair valve on leading unit with 24-RL brake in passenger position, trailing "A" Unit in Passenger lap, "B" Unit controlled emergency cock in passenger position. Release brakes, reverser in desired position, transition lever in Run 1, when equipped, generator field button in, open throttle one notch at a time allowing a short interval between each notch, open throttle sufficiently to obtain desired speed, check to see that all units respond to throttle.

7. Q. How should a train be started?

A. A train should be started slowly, car at a time, to prevent damage to equipment or possible personal injury.

8. Q. How should slack be taken?

A. Slack should be taken by reversing locomotive. If slack has been stretched, hesitate a moment in Run 1, before placing throttle in idle to allow amperage to dissipate in order to prevent heavy arcing of power contactors when placing throttle in idle.

NOTE: Refer to the Rules for the Operation of Air Brake Train Air Signal and Steam Heat Equipment, Locomotives and Cars, to comply with above.

9. Q. What devices in cab should be watched closely during operation?

A. Wheel slip light, speed recorder and load meter, battery charging ammeter, oil pressure and temperature gauges.

10. Q. How should throttle be handled if wheel slipping occurs?

A. Throttle should be reduced one notch at a time until wheel slipping stops, then apply sand and advance throttle to the point that slipping will not occur.

11. Q. What would you do if wheel slip light goes on and off continuously even though throttle is notched down to prevent wheel slipping?

A. Stop train and check wheels while moving slowly to see that all wheels are turning. Traction motor armature may have locked causing wheels to slide and wheel slip light to flash on and off. In the event the wheel slip light comes on and remains on this is an indication of electrical trouble and probably not due to mechanical conditions such as wheels locked and sliding. In the event of a steady wheel slip light, power unit causing same should be isolated and condition reported regarding all known particulars.

12. Q. With no wheel slip indicated by the wheel slip device, what is likely to be the cause of the load ammeter or

transition meter indicator and speed recorder fluctuating? What should be done?

A. This indicates that wheel slip is taking place even though wheel slip device may not be defective. Reduce throttle, apply sand, and return throttle to previous position.

13. Q. What damage is likely if wheels are allowed to slip excessively?

A. Traction motor will flash over tripping ground relay and burning commutator, brushes and motor insulation and damage to rails if standing.

14. Q. What is meant by improper handling of the throttle?

A. Advancing throttle too rapidly causes wheels to slip. Applying sand and setting wheels to rail without first reducing throttle to stop slipping. This could cause terrific stress on pinion gear or motor drive shaft. Could also cause train parting.

15. Q. Is pumping of throttle permissible?

A. No. Throttle should be advanced or reduced one notch at a time, pausing momentarily in each throttle position.

16. Q. Is it permissible to reverse locomotive while in motion?

A. No, except in extreme emergency and then follow special instructions. (Rule 205-A).

17. Q. On EMD passenger units only why is it necessary to return throttle to idle when speed drops below 27 m.p.h.?

A. In order to get power contactors back from parallel to series.

18. Q. What is correct method of handling throttle over railroad crossings at grade?

A. Reduce throttle to 3 position until all trucks have passed over crossing.

19. Q. What is the correct method of handling throttle while

making running test of air brakes or making slow downs with power applied?

A. Automatic brake may be applied with full throttle, but as train speed reduces and amperage increases, throttle must be reduced as speed reduces.

20. Q. In what position should reverser handle be when standing and what protection does this provide?

A. In neutral and insures the throttle being in idle. Reverser cannot be moved with throttle in any other position than idle.

21. Q. Why should locomotive be stopped before moving reverser?

A. To prevent accidental reversing and to prevent arcing at reverser contactor tips or heavy arcing at power contactors and motor brushes, and to prevent sliding of wheels.

22. Q. What damage would result if throttle were left open with reverser in power position while standing?

A. This would cause a power built up and overheating at the traction motors and damage to electric equipment.

23. Q. In what position should transition handle be when stopped and why?

A. In No. 1 position as locomotive cannot be reversed if transition lever is in position 2, 3 or 4.

24. Q. In what position should the transition lever be placed preparatory to moving a locomotive with automatic transition?

A. (a) On EMD, place in "on" or No. 1 position and do not change.

(b) On Alco and FM, place in No. 1 position and move to No. 4 position after starting.

25. Q. How could transition be forestalled on the following:

A. 1. Alco and F.M. (G.E. equipped)?
By leaving transition handle in desired transition position.

2. F.M. ("C" line), E.M.D. freight, passenger and road switcher?
   By keeping throttle below full position.
3. Alco and E.M.D. 1000 H.P. switcher?
   By keeping transition switch in series.

26. Q. Under what conditions would it be desirable to forestall transition?
    A. Flat switching, short grades where a higher transition would cause cycling of automatic transition or an overload on switchers.

27. Q. If the locomotive will run in series but will not transfer to parallel, what should be done?
    A. Continue to operate in series.

28. Q. If a locomotive makes transition, and immediately drops out of the transition just made, what should be done?
    A. Operate the locomotive up to the highest transition it will remain in by forestalling the transition.

29. Q. How would you operate with a defective transition meter?
    A. Move transition lever in accordance with speed of the locomotive.

30. Q. If the locomotive will run in series and parallel but will not transfer to shunt, what should be done?
    A. Continue to operate in series or parallel.

31. Q. On units with manual transition, how should transition lever be handled?
    A. 1. *Accelerating*—With throttle in Run 8 as pointer on load or transition meter moves from right to left and enters the area of transition 2 from 1 move transition lever to 2 as pointer moves to 3, reduce throttle to 6, then move lever to 3, open throttle, as pointer moves to 4, move lever to 4. True reading

of transition meter only registers in the 8th throttle position.

2. *Decelerating*—Follow indication of pointer with lever reducing throttle to 6 when moving from 3 to 2 after which again advance throttle as power is desired.

32. Q What possible damage would result from working a unit in higher transition than meter calls for?

A. Electrical equipment would be tremendously overloaded, causing damage.

33. Q. On switch power, what is a current warning relay? When does it operate and what should be done to eliminate cause?

A. It indicates an electrical overload in parallel and lights the wheel slip light. Unit must be returned to series. On some models this light will light momentarily when making transition from series to parallel.

34. Q. What possible damage would result from failing to comply if current warning relay picks up?

A. The main generator would overheat causing damage.

35. Q. In using dynamic brakes, how must the throttle lever be handled?

A. When the dynamic brake is to be used place the throttle in idle after pausing in each throttle position.

36. Q. How should the dynamic brake be applied on the various types of locomotives?

A. (a) On EMD return throttle to idle, pause, and place transition lever in "off." Allow slack to bunch, then move dynamic brake lever over the quadrant to the right until the desired or permissible braking effort is attained.

(b) On Alco, Fairbanks-Morse return throttle to idle, pause, and place transition lever in "B." Allow slack to bunch, then slowly move transition lever to the right until desired or permissible braking effort is attained.

(c) On Baldwin, Baldwin-Lima-Hamilton return throttle to off, allow slack to bunch, move reverse lever to "Dynamic Braking" position (trip latch under the lever to release the reverse lever). Advance throttle to first notch and wait for braking current to indicate on loadmeter, then advance throttle until desired or permissible (750 amps) braking effort is attained. Dynamic brake warning light will come on if brake is used excessively. Move throttle toward off until light goes out.

37. Q. What does the dynamic brake warning light indicate and what should be done to eliminate it?

A. An electrical overload from dynamic braking. Handle should be moved to left until light goes out.

38. Q. Should the dynamic brake grid cooling fans be checked for operation, and what must be done if they do not operate?

A. Yes. If fans do not operate, dynamic brake must not be used, report on arrival.

39. Q. What would be the result if grid cooling fans failed to operate when brake was used?

A. The resistance grids would overheat and be damaged.

40. Q. How should the dynamic brake be released?

A. Release of the dynamic brake should be made gradually to avoid runout slack in the train under certain conditions. Keep in mind that the dynamic brake has somewhat the same effect as the powerful independent air brake and be governed accordingly. When releasing the dynamic brake, a light application of indepenedent air is made, as the handle is moving from B to off, and the independent brake is then slowly released. This action should be taken if grade conditions are such that the locomotive will tend to "run away" from the train when the dynamic brake is released.

41. Q. What care must be taken in regard to slack action when applying and releasing dynamic brake?

A. Careful handling of the dynamic brake is very essential to prevent harsh slack action causing damage or possible personal injury.

42. Q. Should engines be taken off the line on a diesel locomotive during dynamic braking?

A. No. If it becomes necessary to isolate an engine during dynamic braking, the dynamic brake should be released entirely before taking engine off the line. If a unit is left off the line and dynamic braking is desired from remaining units on EMD or Fairbanks (DFA-5&6, DFA&B-9) freight locomotives, the unit selector switch in the operating cab should be moved to the appropriate position (number of effective units) before using dynamic brake.

43. Q. How would you cut out automatic train stop?

A. Cut out automatic train stop at EP valve.

44. Q. Under what conditions would train stop check light fail to give any indication?

A. 1. A bulb being burned out.
2. Motor generator not supplying sufficient voltage, which would result in train stop failure.

45. Q. How should locomotive be left for layover?

A. Engines shut down when required, hand brake applied, control switches or circuit breaker open, main battery switches open, cylinder test cocks open if equipped. Protect from freezing if necessary or drain cooling system and follow local instructions.

46. Q. How often should inspection of the engine room be made?

A. As often as operating conditions will permit.

47. Q. What should be inspected in the engine room?

A. Locomotive standing (or running if operating conditions permit):
1. Engine water temperature.
2. Fan operation.

3. Cooling water supply.
4. Lube oil pressure and supply.
5. Fuel pump operation.
6. Battery charging meter.
7. Check for stuck starting contactors.
8. Leaks in water, oil, fuel and air lines.
9. Governor oil.
10. Steam generator.

48. Q. What is a load meter?
A. A load meter is an instrument which measures the current being delivered to a traction motor.

49. Q. What causes a fuse to blow or circuit breaker to trip?
A. Excessive current in the line.

50. Q. How can a blown fuse be distinguished from a fuse which is not blown?
A. On locomotives so equipped, a test light, switch and blocks will be found in the low voltage cabinet. The switch should first be flipped to the "On" position and the test light should light. The fuse should then be placed with one of its contacts on each of the test blocks. If the fuse is not blown the light will light. If it is blown the light will not light.

51. Q. How would you check for no fuel oil pressure?
A. If there is low pressure on the fuel gauge make certain the fuel pump is running and the fuel pump coupling is connected. If running then check the emergency fuel valve. On E.M.D. locomotives if no fuel is showing on either the 5 or 60 p.s.i. sight glasses take the same action as noted above. If fuel is showing in the 60 p.s.i. sight glass only, it is an indication that discharge filters are in need of change (E.M.D.). On E.M.D. locomotives bubbles in the 5 p.s.i. sight glass can indicate a fuel suction line air leak or a leaking unit injector.

52. Q. What would indicate that a circuit breaker was tripped?

A. Knob on breaker would be in the midway position, to reset move to full "OFF" and back to "ON" position.

53. Q. What damage might result to equipment if sufficient amount of fuel is not passing through the system?

A. Fuel injectors would overheat, causing sticking or damaged injectors.

54. Q. If insufficient fuel is being delivered, would engine load properly?

A. No.

55. Q. In what two ways is scavenging air obtained?

A. By a gear driven blower or a turbine driven blower. The turbine receiving its power from engine exhaust.

56. Q. If low oil pressure switch trips twice when starting engine after 45 second period, what must be done?

A. Shut down engine and report upon arrival. Examine oil level in engine by looking at dip stick.

57. Q. On any diesel engine if there is insufficient lube oil pressure, what must be done?

A. Shut down engine, report trouble. Tag same.

58. Q. How could a leaky lube oil cooler be detected?

A. The cooling system would be contaminated with oil and oil would show in cooling water level sight glass when so equipped.

59. Q. Explain the difference between high and low temperature reading on engine cooling water temperature gauge due to low water in the cooling system.

A. High temperature would indicate water was still in engine cooling system above thermal element, low temperature would indicate water below engine temperature element.

60. Q. How should a hot engine be handled?
    A. Take engine off the line. Investigate water level, shutters, cooling fans, lube oil, put on manual control if necessary. If engine does not cool in 5 minutes, shut down. Under no circumstances remove air box or crankase covers until engine has cooled down.

61. Q. What damage might result from overheated engine cooling system?
    A. Warped engine block, cracked cylinder heads, damaged gaskets and seals.

62. Q. What will cause pneumatic control (PC) to function?
    A. 1. Automatic train stop application.
    2. Emergency application of air brakes.

63. Q. How do you recover from each?
    A. 1. Lap brake valve, place throttle in idle position. After train has stopped, reset. When (PC) light goes out release brakes in the usual manner.
    2. Lap brake valve, place throttle in idle position, after train has stopped place brake valve in release position, if (PC) light does not go out promptly, lap brake valve to save air supply, close brake pipe angle cock at rear of leading unit. Place brake valve in release position, PC light should go out promptly. If main reservoir pressure is low, place reverser in neutral open throttle to notch 3 until pressure is normal. Open brake pipe angle cock very slowly to prevent a reapplication of locomative brakes. Make standing test of brakes in usual manner.

64. Q. How is a dynamic brake operated?
    A. It is operated by a combination of reversing the current in traction motor armature coils and the use of separate excitation of the traction motor field coils. This permits each traction motor to act as a generator, and the

energy is dissipated as heat through air cooled grid resistors.

65. Q. What action should be taken when a crankcase dilution is detected?

A. Engine should be shut down immediately to prevent internal damage.

66. Q. How is dilution detected in the crankcase?

A. The combination of low lube oil pressure, excessive oil level in the crankcase as indicated by the dip stick, and exceedingly black thin oil indicates crankcase dilution.

67. Q. What is meant by motors in series?

A. Motors in series means the flow of current starts from the main generators and must flow thru each motor and return to the generator.

68. Q. Would a break in this circuit affect all motors?

A. Yes.

69. Q. What is meant by series parallel?

A. Series parallel means there are two or more motors in series, but each truck of the locomotive is in parallel. The total current in the circuit will be divided equally between each of the trucks.

70. Q. Would a break in this circuit affect all motors?

A. It would affect only the pair of motors in the broken circuit.

71. Q. What is meant by motors in parallel?

A. A parallel circuit is a circuit divided in such a manner that an equal part of electrical energy flows through each motor and returns to the generator.

72. Q. What is meant by field shunting?

A. Shunting is by-passing a certain amount of current to weaken the field coils, thereby reducing counter electric motive force or back pressure, which increases the motor speed.

73. Q. What is a unit selector switch? (EMD and FM-C line).

A. A four position switch in the cab to provide means of keeping excitation of motor fields at proper values while using dynamic brake. It must be set to number of units involved by engineman if unit is set out or unit added.

74. Q. What position of engine throttle should be used in pumping up train?

A. The lowest position possible to allow brake system to be charged with the least possible delay, but in no case should the engine be allowed to run at a speed which will be detrimental to the equipment under no load or nearly no load.

75. Q. What are the duties of the engineman after placing locomotive on designated track on completion of trip or day's work?

A. Remove reverse lever, open GF switch. Stop engines and plug in immersion heater if necessary, inspect engine room and running gear, report defects in log book, fill out other required forms, register off duty. Close all windows and doors. Comply with air brake rules.

76. Q. What must engineman do at completion of every trip in reference to delays and failures?

A. He must report all delays and failures to the proper authorities on arrival. If possible identify the defects. NOTE: All doors must be kept closed on units while en route.

THIRD SERIES

DIESEL ELECTRIC LOCOMOTIVES

The Relative Values of Answers in Per Cent

Question	Value	Question	Value	Question	Value
1	2	27	1	53	1
2	2	28	1	54	1
3	4	29	1	55	1
4	2	30	2	56	1
5	2	31	1	57	1
6	2	32	1	58	1
7	2	33	1	59	1
8	2	34	1	60	1
9	1	35	1	61	2
10	1	36	4	62	2
11	2	37	1	63	2
12	2	38	1	64	2
13	2	39	1	65	1
14	1	40	1	66	1
15	1	41	1	67	1
16	1	42	1	68	1
17	1	43	1	69	1
18	1	44	1	70	1
19	1	45	1	71	1
20	1	46	1	72	1
21	1	47	2	73	1
22	1	48	1	74	1
23	1	49	1	75	1
24	1	50	2	76	1
25	1	51	2		
26	1	52	1		

TOTAL 100

THIRD SERIES — AIR BRAKE

1. Q. How should brake pipe be tested for leakage on a locomotive?

   A. Make a reduction of 10 lbs. from standard brake pipe pressure, move the handle to lap position; then check the brake pipe leakage as noted on the brake pipe gauge, which must not exceed 3 lbs. per minute.

2. Q. What are the duties of enginemen in regard to checking locomotive brake equipment prior to leaving engine terminal?

   A. 1. Moisture to be drained from main reservoirs.
   2. Various valves and cut-out cocks are in proper position for service intended. Test signal line and whistle when used.
   3. Air gauges indicate proper pressure.
   4. That automatic and independent brakes function properly.
   5. Brake cylinder piston travel is within prescribed limits.
   6. Air hose not in use is held in dummy coupling.
   7. Check hand brakes to see if operating properly and are fully released before moving.

3. Q. How should the brakes be left on locomotive unattended?

   A. In accordance with local instructions.

4. Q. How can brakes be cut out on diesel locomotives?

   A. By closing side vent cut-out cocks in brake cylinder pipes at trucks.

5. Q. If necessary to make a switch on a passenger train with a locomotive assigned to freight service, what adjustment should be made on the freight locomotive?

   A. Adjust brake pipe feed valve for passenger service and properly position controlled emergency feature on lead unit to "P" (Pass.), "PL" (Pass. Lap) on trailing unit, or on "B" units to "P" position.

6. Q. Why should the rotair valve of 24-RL equipment be in "Pass." position when locomotive is moved light or for passenger movement?

   A. To permit a rapid development of brake cylinder pressure on the locomotive in case of an emergency.

7. Q. What is the function of controlled emergency?

   A. With controlled emergency cock in "F" position or rotair valve in either "FRT" or "FRT. LAP" position, in an emergency brake application, the development of locomotive brake cylinder pressure is controlled, or delayed, for purpose of allowing adjustment of train slack before locomotive brake applies to maximum pressure.

8. Q. Where is the controlled emergency cock located on 8-EL brake equipment and how positioned?

   A. On right side of independent brake valve, positioned in "P" position for light or passenger and "F" for freight.

9. Q. Where is the controlled emergency cock located on 24-RL equipment and how must it be positioned?

   A. On the "B" units the controlled emergency cock is located on the control valve and must be positioned in "P" position for passenger or light movement, and "F" for freight only when coupled to a train.

   On the "A" units the rotair valve functions to position the controlled emergency feature and no cut-out cock is needed on the control valve.

10. Q. What is the function of a rotair valve (24-RL equipment)?

    A. The rotair valve combines in one valve certain operations which would otherwise require several independent cut-out cocks.

    The rotair valve accomplishes the following functions in the four handle position:

    "FRT."—The independent brake valve and the controlled emergency feature are both cut in and operative.

"FRT. LAP"—The independent brake is cut out but the controlled emergency feature is retained and operative.

"PASS. LAP"—Both the independent brake and the controlled emergency feature are cut out.

"PASS."—The independent brake is cut in but the controlled emergency feature is cut out or annulled.

11. Q. Where is rotair valve located and how must it be positioned?

A. Located near engineer's control stand and positioned as follows:

Passenger or Light

Place rotair valve in leading cab in "PASS." position. Trailing "A" unit must be in "PASS. LAP" position.

Freight

Place rotair valve in leading cab in "FRT." position. Trailing "A" unit must be in "FRT. LAP" position.

12. Q. What position should rotair valve be in when moving engine around engine terminal or yard?

A. In "PASS." position.

13. Q. If rotair valve was left in lap on leading or single unit, would you have use of independent brake?

A. No.

14. Q. In what way does the D-22-ER control valve differ from the D-24?

A. The D-22-ER control valve has no controlled emergency or DEAD ENGINE portions. The DEAD ENGINE feature is accomplished by a separate fixture. The D-22-ER control valve is not used with dynamic brake and has no dynamic interlock portion.

15. Q. How can controlled emergency be annulled on leading "A" unit having 24-RL equipment when rotair valve

is in "F" position or on 8-EL equipment not having a rotair valve during an emergency application?

A. By holding independent brake valve handle in full application position.

16. Q. What is the purpose of the brake-in-two protection feature incorporated in the 24-RL equipment on some locomotives?

A. To prevent the loss of main reservoir air through the open brake pipe if the brake valve handle is left in running position.

17. Q. What air lines and hose are necessary between units on locomotives having 24-RL equipment when used in multiple unit service?

A. Brake pipe, main reservoir equalizer pipe, independent application and release pipe, actuating pipe, signal pipe, sand pipe and throttle control air lines, and brake cylinder equalizing hose, when used.

18. Q. What air lines and hose are necessary between units on locomotives having 6-BL or 6-SL equipment when used in multiple unit service?

A. Brake pipe, main reservoir equalizing pipe, equalizing (brake cylinder) pipe, sand pipes and signal pipe if used.

19. Q. What is the purpose of the main reservoir safety valve?

A. To protect the main reservoir against excessive air pressure if the governor should fail to unload the compressor.

20. Q. What is the purpose of the safety valve on discharge line near compressor, when used?

A. To prevent personal injury or damage to equipment should the discharge pipe or radiating pipe become plugged or frozen up between the compressor and the main reservoir safety valve.

21. Q. Do the self-lapping independent brake valves require a reducing valve?

A. No. Spring tension on exhaust piston assembly controls the amount of air that will be delivered to brake cylinder relay valve or brake cylinders.

22. Q. How is oil level in the mechanical-driven compressor crank case checked?

A. By means of a bayonet gauge where used, but diesel engine must be shut down to get a true reading.

23. Q. Are automatic slack adjusters beneficial?

A. Yes. They maintain a standard uniform piston travel.

24. Q. When air compressor is operating normally and loaded, how much air pressure should be shown on the intercooler gauge?

A. Approximately 30 lbs.

25. Q. When making a brake pipe service reduction in automatic brake operation, what reservoir air pressure is utilized for measuring required reduction and what air gauge indicates amount of reduction?

A. Equalizing reservoir air pressure as indicated by equalizing reservoir gauge.

26. Q. Under what conditions, when running, is it permissible to release brakes when braking in automatic brake operation to insure that triple and/or control valves on cars will properly function to release brakes?

A. Only after making brake application totaling not less than 12 lbs. for passenger trains and 15 lbs. for freight trains.

27. Q. At what speed is the dynamic brake most effective?

A. At speeds between 15 and 25 miles per hour.

28. Q. Should the dynamic brake be used to stop a train?

A. No.

29. Q. Should sand be used with the dynamic brake?
    A. Yes. Sand must be used to prevent sliding.

30. Q. What indicates the effectiveness of the dynamic brake?
    A. The load meter.

31. Q. What would indicate excessive dynamic braking?
    A. Dynamic brake warning light or color markings on dial of load meter.

32. Q. Is it permissible to use the automatic (train) brakes when the dynamic brake is in use?
    A. Yes, but brake cylinder pressure must not be permitted to develop on the locomotive.

33. Q. What is the dynamic interlock portion?
    A. A portion of the control valve which functions to prevent development of brake cylinder pressure on the locomotive as a result of an automatic service brake application made while the dynamic brake is being used.

34. Q. Is it sufficient that an engineman rely on the dynamic brake interlock to prevent development of brake cylinder pressure on the locomotive while using dynamic brakes and automatic (air) train brakes?
    A. No. Engineman must be alert at all times to observe that brake cylinder pressure does not develop on the locomotive, and to take immediate action to release such pressure by depressing independent brake valve handle and bail in release position should it appear under these conditions.

35. Q. Does the dynamic interlock prevent manual application of the independent brake?
    A. No.

36. Q. Is it ever permissible to use the independent brake on the locomotive while using dynamic brake?
    A. No. Except that a brake cylinder pressure not to ex-

ceed 15 lbs. may be used to prevent runout of slack when releasing the dynamic brake.

37. Q. Is it possible to obtain a train stop or emergency application of the brakes on the locomotive (and train) while the dynamic brake is in use?

A. Yes. Any of the stated applications nullifies effect of the dynamic interlock portion and permits development of brake cylinder pressure on the locomotive in a normal manner.

38. Q. How is the dynamic interlock portion tested before leaving a locomotive terminal?

A. With brakes released on the locomotive, the selector lever should be placed in Dynamic Braking Zone ("B") and a full service brake pipe reduction made with the automatic brake. Brakes should not apply on the locomotive until the selector lever is moved out of Dynamic Braking Zone.

39. Q. How should service stop with a long freight train be made?

A. Refer to Rule 1565 of "Rules for the Operating and Supervision of Air Brake, Train Air Signal and Steam Heat Equipment, Locomotives and Cars."

40. Q. In making stop with freight train, why must brakes not be released until train has stopped?

A. To prevent parting due to slack action.

41. Q. How must sand be used to assist holding power of brakes and prevent wheels sliding?

A. Entire train should be on sand before train is reduced to slow speed and heavy brake application is made. Rails must be kept sanded until train stops.

42. Q. What must be done to minimize sliding of wheels?

A. Avoid high brake cylinder pressure at slow speed.

43. Q. If train brakes are dragging, how can they be released from locomotive?

A. By making sufficiently heavy brake pipe reduction to apply all brakes in train and then releasing provided speed of train permits.

44. Q. What brake pipe reduction is required to make a full service application?

A. 25 lbs.

45. Q. How must terminal test of brakes be made?

A. In accordance with Rules 1532 through 1542, as may apply, book of "Rules for the Operation and Supervision of Air Brake, Train Air Signal and Steam Heat Equipment, Locomotives and Cars."

46. Q. How should slow downs be made with freight trains?

A. In accordance with Rule 1568 of book of "Rules for the Operation and Supervision of Air Brake, Train Air Signal and Steam Heat Equipment, Locomotives and Cars."

47. Q. When and how must running test be made?

A. The running test must be made as soon as train speed will permit without stalling, in accordance with Rule 1554 of "Rules for the Operation and Supervision of Air Brake, Train Air Signal and Steam Heat Equipment, Locomotive and Cars."

48. Q. What is the purpose of the running test made on trains operating at passenger, mail, express and milk train speeds?

A. To ascertain whether brakes are functioning properly to develop the braking force to be expected.

49. Q. Why must repeated application and release of brakes, without giving time for brake system recharge, be avoided?

A. Braking power would be lost because feed ports in distributing valve and control valves are not sufficiently

large to permit full recharging of brake system between applications.

50. Q. What is purpose of retaining valve on cars?
    A. To retain pressure in brake cylinders while brake system is recharging.

51. Q. What is indicated when making service application if brake pipe exhaust port closes quickly and brakes go on hard?
    A. Brakes have applied in emergency.

52. Q. When brakes apply suddenly, what must engineman do?
    A. Gradually shut off power, place brake valve handle in lap position until train has stopped and protect all tracks.

53. Q. When should brakes be released after an emergency application?
    A. Not until after train has stopped and brake valve left in lap position one minute.

54. Q. What must be done to assist in locating a burst hose or heavy brake pipe leaks?
    A. Brake valve must be placed in running position after PC light has gone out.

55. Q. What brakes must be used to hold train while standing on grade?
    A. Brakes should be used in accordance with Rules 1570 and 1577 of "Rules for the Operation and Supervision of Air Brake, Train Air Signal and Steam Heat Equipment, Locomotives and Cars."

56. Q. If whistle signal fails to operate, what must be done?
    A. See that air signal line is properly charged, that cut-out cocks are open and examine for defective signal valve, leaks in signal line or defective car discharge valves. If defect cannot be corrected without undue delay it is permissible for train to proceed using hand signal ex-

cept over Canada Division. Train and locomotive crews must be notified accordingly.

57. Q. What comprises the air signal system?
A. A reducing valve, strainer and check valve, whistle sounding valve, with signal line connection to car discharge valves at #2 end of "A" units, both ends of "B" units, and in cars throughout train.

58. Q. If air signal line is not properly charged, what is the probable cause?
A. The reducing valve may be cut out, improperly adjusted or may be defective. There may be excessive signal line leakage.

59. Q. How should air be pumped up on a train when standing?
A. Place reverser in neutral, advance throttle to the lowest position possible to allow reservoirs to be pumped up with the least possible delay, but in no case should the engine be allowed to run at a speed which will be detrimental to the equipment under no load or nearly no load.

60. Q. How would you pump up air when descending grade on locomotives NOT equipped with dynamic brakes?
A. Leave reverser in direction locomotive is moving. Pull generator field switch. Advance throttle to not more than Notch 3 or equivalent to speed up engines and compressors to maintain proper main reservoir pressure.

61. Q. Describe briefly the portions of the D-24 control valve. (24-RL equipment.)
A. (a) Pipe bracket to which all necessary pipes are connected.
(b) Service portions which control charging of auxiliary and emergency reservoirs, service application and release of the locomotive brake, also graduated release feature.

(c) The emergency portion, when actuated by emergency rate of brake pipe reduction from any cause, provides high emergency brake cylinder pressure, also operates the automatic sanding device when so equipped. It also provides improved emergency transmission and accelerated release after emergency.

(d) Independent application and release portion, which interlocks the automatic and independent brakes, provides independent application and release, also independent release of automatic applications on the locomotives.

(e) Controlled emergency portion, which provides for controlled or non-controlled build-up of brake cylinder pressure, depending upon position of controlled emergency cock or rotair valve.

(f) Dead engine portion provides for charging the main reservoir from the brake pipe on a locomotive being handled DEAD in a train.

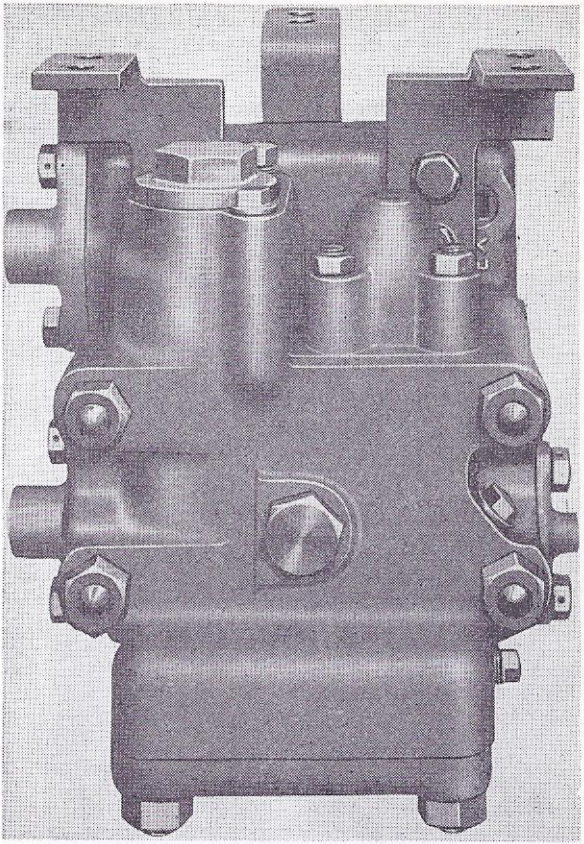
(g) Dynamic interlock portion is used on locomotives equipped with dynamic brakes to nullify automatic braking on the locomotive when using dynamic braking, protecting locomotive wheels from sliding due to excessive braking.

62. Q. Describe briefly the purpose of three compartment reservoir.

A. (a) The auxiliary reservoir pressure is used to provide proper functioning of the control valve service portion during automatic service brake application.

(b) The emergency reservoir pressure is used to provide high emergency pressures, quick recharge, power cut off, and accelerated release after emergency application.

(c) The displacement reservoir is to provide a volume to the relay valve and in conjunction with the spring loaded diaphragm which acts to provide uniform action of locomotive and car brakes.



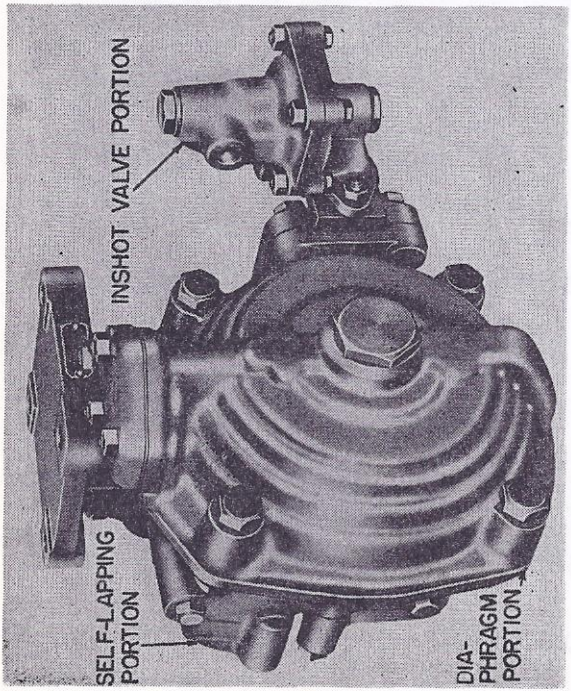
B-3-A Relay Valve

63. Q. What is the purpose of the "B" and "F-6" type brake cylinder relay valves?

A. To relay main reservoir pressure to the brake cylinders as called for by the application and release operation of the distributing or control valve.

64. Q. What is the difference between the "B" type brake cylinder relay valve and the "F-6" type brake cylinder relay valve?

A. The "B" type relay is operated by a piston and gives a brake cylinder pressure approximately equal to control pipe pressure.



F-6 Relay Valve

The "F-6" type brake cylinder relay has an inshot valve, also four differential diaphragms in place of the piston, the 60% diaphragm being the controlling diaphragm. This relay gives a brake cylinder pressure of approximately 60% of the control pipe pressure.

NOTE: The "F-6" type brake cylinder relay valve is used on passenger locomotives due to a higher braking ratio on these locomotives.

65. Q. What is the purpose of the brake application valve cut-out cock?

A. To provide ready means for annulling train stop in event of defects developing. When this cock is closed in train stop territory, train must be operated in accordance with timetable instructions covering inoperative train stop.

66. Q. Where is the graduated release cap located?

A. On the control valve service portion.

67. Q. What is the purpose of this cap?

A. To condition the valve for graduated or direct release.

68. Q. How is the graduated release cap positioned?

A. To set the cap for graduated release of brakes, the cap should be turned so that the letters "GRA," cast on the cap, stand next to the letters "REL" cast on the pipe bracket. For direct release, the letters "DIR" on the cap should stand next to the letters "REL."

Locomotives in passenger service must be set for Graduated Release, those in freight service for Direct Release. DRS Units having 24-RL brake equipment will be set for Direct Release at all times.

69. Q. What action of air brakes automatically nullifies operation of Dynamic Interlock and Dynamic Interlock valve portion, and allows locomotive air brakes to apply?

A. When train stop functions, or an emergency brake application occurs.

70. Q. What action must be taken after brakes are automatically applied as outlined by Question 69 above?

A. Dynamic brake operating lever must be immediately moved from dynamic braking zone to OFF position.

71. Q. If dynamic interlock valve portion becomes inoperative, what action must be taken to keep the locomotive air brakes released while dynamic brake is in use?

A. The locomotive air brake must be kept released by holding the independent brake valve handle in release position and bail depressed.

72. Q. How would you position three-position double heading cock for 2, 3 or 4 unit locomotive?

A. Lead or #1 on the leading unit and trail or #2 on all other units.

73. Q. What position should the three-position double heading cock be in when double heading two, two unit diesel locomotives with two crews?

Crew	*Crew*
Lead or #1—Trail or #2	Dead or #3—Trail or #2

74. Q. How would you position rotair valve when you are double heading with 24-RL equipment, two crews?

A. The second crew would position rotair valve the same as leading crew.

75. Q. What is the standard piston travel for locomotives?

A. In accordance with Rule 1514 of book of "Rules for the Operation and Supervision of Air Brakes, Train Air Signal and Steam Heat Equipment, Locomotives and Cars."

76. Q. What is the purpose of signal line on AB-1-B Pacemaker freight car equipment?

A. Signal line when charged to at least 30 lbs. allows brake

cylinder pressure to by pass 3 stage build up of brake cylinder pressure in emergency.

NOTE: If signal line is broken or cars are added without signal line, train reverts to freight train instructions.

77. Q. How is brake pipe pressure and rotair valve set for Pacemaker freight service?

A. Brake pipe pressure should be 110 lbs. and rotair valve in passenger position on leading "A" Unit and Pass. Lap on trailing "A" Unit, "B" Unit controlled emergency cock in passenger position.

78. Q. How should stop with passenger, mail, express or milk train be made?

A. Refer to Rules 1562 and 1563 of "Rules for the Operation and Supervision of Air Brake, Train Air Signal and Steam Heat Equipment, Locomotives and Cars."

79. Q. With the AB or AB-1-B car brake equipment, is emergency available after a full service application of the brakes?

A. Yes.

80. Q. Where is vent valve located in 24-RL equipment?

A. It is located in the emergency portion of control valve.

81. Q. How would you recover from emergency application of the brakes?

A. Place brake valve handle in lap position for one minute, then place brake valve in running position.

82. Q. When making a service application with the automatic brake valve, where does the first discharge of air come from?

A. It comes from the equalizing reservoir preliminary exhaust port.

83. Q. If brake has been applied with either the automatic or independent brake valves, and main reservoir pressure

cannot be maintained while brakes are applied, what is cause?

A. Brake cylinder packing cups leak or brake cylinder pipe is leaking or broken.

84. Q. After release of brakes, before starting a freight train, what should be observed closely?

A. See that all brakes have released on all units, depress independent brake valve in release position. Do not attempt to start train until all train brakes have had proper time to release. (See Rule 1565 of "Rules for the Operation and Supervision of Air Brake, Train Air Signal and Steam Heat Equipment, Locomotives and Cars.")

85. Q. What will occur if brake valve handle is left in full release position too long before moving it to running position with #6 equipment?

A. Would overcharge brake pipe and reservoirs and cause sticking brakes.

86. Q. What must be done when locomotive brakes do not release with handle of independent brake in release position?

A. Make a full service brake application with automatic brake and release in running position, speed permitting.

87. Q. Where is the dead engine cock located?

A. On or near control or distributing valves.

88. Q. What precaution should be taken when making slow downs with freight or passenger trains?

A. Apply automatic brake and reduce throttle position as amperage increases to prevent undesirable slack action.

89. Q. In case of emergency, what means is available for applying the brakes other than with the brake valve?

A. Large capacity emergency valves have been provided at standardized locations for maximum safety.

AIR BRAKE

The Relative Values of Answers in Per Cent

Question	Value	Question	Value	Question	Value
1	1	31	1	61	2
2	1	32	1	62	1
3	1	33	1	63	1
4	1	34	1	64	1
5	1	35	1	65	1
6	1	36	1	66	1
7	1	37	1	67	1
8	1	38	2	68	1
9	1	39	1	69	1
10	2	40	1	70	1
11	1	41	1	71	1
12	1	42	1	72	1
13	1	43	3	73	1
14	1	44	1	74	1
15	1	45	3	75	1
16	1	46	2	76	1
17	1	47	1	77	1
18	1	48	1	78	1
19	1	49	1	79	1
20	1	50	1	80	1
21	1	51	1	81	1
22	1	52	3	82	1
23	1	53	1	83	1
24	1	54	1	84	1
25	1	55	1	85	1
26	2	56	1	86	1
27	1	57	1	87	1
28	1	58	1	88	1
29	1	59	1	89	1
30	1	60	1		
				TOTAL	100

MECHANICAL

THIRD SERIES — SPEED RECORDER

1. Q. What is the purpose of the speed recorder?
   A. To indicate to the engineman, at all times, the speed of the locomotive, also to provide a continuous record of the speed as well as the restrictive signals at which the operation of the automatic train stop is forestalled or applied and reset.

2. Q. What is the speed recorder range?
   A. From 10 to 120 m.p.h.

3. Q. Why is the speed recorder tape compartment sealed?
   A. To prevent marking of the tape by any means except the pencils provided in the recorder and thus assure an impartial witness in event of accident or question of proper observance of speed restrictions or signal rules.

4. Q. What action should be taken if tape compartment is not sealed?
   A. Foreman should be contacted and recorder sealed before departure from initial terminal.

5. Q. Who may remove tapes?
   A. Only authorized employes.

6. Q. If tape is removed by authorized person while you are in charge of locomotive, what action should you take for your protection?
   A. Insist that notation be made in log book and signed by the man removing the tape. If no log book is available, report on arrival at terminal.

7. Q. Can a recorder indicate one speed and record a different speed?
   A. No. The pointer and pencil are connected by gears so that they must always agree.

8. Q. How is the speed recorder driven?
   A. From the end of a locomotive axle through gears and flexible shaft.

9. Q. In event speed recorder fails to operate or is found to be inaccurate, what action should be taken?
   A. Make notation in log book immediately and operate train according to timetable schedule and report on arrival.

10. Q. What is the A.T.S. forestalling recorder?
    A. A pencil unit in the speed recorder which marks the tape to show that a signal was restrictive when passed or that the train stop had applied or was forestalled.

11. Q. Does the A.T.S. forestalling recorder show each time the acknowledging handle is operated?
    A. No. It records only when the acknowledging whistle or gong sounds or train stop applies.

12. Q. What does the A.T.S. forestalling recorder show when the train stop applies?
    A. It shows:
    1. Where train stop applied.
    2. Distance to stop.
    3. Point where train stop was reset.

AUTOMATIC TRAIN STOP

General Railway Signal Company's Intermittent Inductive Auto-manual type, Union Switch and Signal Company's Intermittent Inductive Automatic Train Stop.
All questions and answers pertain to both US&S and GRS unless otherwise specified.

13. Q. State briefly what action takes place in the operation of the automatic train stop.
    A. Receiver is supplied with current by motor generator set and when receiver is moved over inductor at a speed of not less than two miles per hour, at signal giving indication at which forestalling is permitted, automatic train stop impulse is received, which causes the E.P. valve to be de-energized, thereby venting air from the

application valve, causing automatic train stop brake application, unless forestalled.

14. Q. Will manual operation of air brake be affected if automatic train stop is cut out?

A. No.

15. Q. After a brake application, how can engineman determine that it was caused by automatic train stop?

A. Automatic train stop check light will become lighted.

16. Q. What must be the position of forestalling lever when forestalling?

A. In full forestalling position.

17. Q. How is proper receiver selected for forward or reverse movement of locomotive when equipped with receiver both sides?

A. By interlock on reverser drum and directional relay.

18. Q. When seals are broken what must be done with them?

A. They must be turned in with report of defects on the proper SC-1 forms, and MP-193.

19. Q. What must be done if forestalling whistle or gong fails to sound while forestalling at signal giving indication at which forestalling is permitted?

A. Make report on proper forms. Operating Rules and Special Instructions must be complied with.

20. Q. What must be done if automatic train stop becomes inoperative?

A. Cut out automatic train stop device at E.P. valve and make report on proper forms. Operating Rules and Special Instructions must be complied with.

21. Q. On what form must defects in automatic train stop device be reported?

A. Form MP-193, SC-1.

22. Q. When locomotive crews are changed and locomotive continues through on train, what information does

engineman delivering locomotive give to engineman receiving locomotive so that the latter can make proper report?

A. Explain to receiving engineman any irregular operation of the automatic train stop device.

23. Q. Should the engineman reset after the second undesired application of automatic train stop?

A. No. Cut out and make out SC-1 reports.

24. Q. If automatic train stop application occurs from any cause, must it be reported? On what forms?

A. Yes, on Signal and Automatic Train stop Report, form SC-1 Card; Diesel Electric Locomotive Inspection Report, form MP-193.

25. Q. What disposition must be made of form SC-1?

A. Leave at first open communication office at which stop is made.

26. Q. Where will form MP-193 be made?

A. At terminal where locomotive is delivered.

THIRD SERIES

SPEED RECORDER—A.T.S., G.R.S., U.S.&S. COMBINED

The Relative Values of Answers in Per Cent

Question	Value	Question	Value	Question	Value
1	3	10	4	19	3
2	2	11	3	20	4
3	3	12	5	21	4
4	4	13	15	22	3
5	2	14	3	23	4
6	3	15	4	24	3
7	3	16	3	25	3
8	5	17	3	26	3
9	4	18	4		—
				TOTAL	100

THIRD SERIES—RAIL DIESEL CARS—AIR BRAKE

1. Q. How must a hand brake RUNNING TEST on a Rail Diesel Car be made?

   A. In accordance with SPECIAL INSTRUCTIONS OF A CURRENT TIMETABLE ON DIVISIONS OR SUB-DIVISIONS ON WHICH RAIL DIESEL CARS ARE OPERATED, which reads as follows:

   A RUNNING TEST of hand brakes must be made on a Rail Diesel Car upon leaving initial terminal when operating as a single unit. As soon as speed permits, engineman must reduce throttle to No. 1 and signal for brakes. The conductor or member of the train crew must apply hand brakes to determine if they are operating properly. In case hand brakes do not operate properly, Rail Diesel Car must proceed at restricted speed to the next point at which repairs can be made.

2. Q. What must be done at the completion of a trip?

   A. 1. Make a 25-pound brake pipe reduction.
   2. Close double-heading cock located above the floor to the right of the operator's seat.
   3. Remove throttle, reverse lever, and M-23 brake valve handle.
   4. Check windshield wiper, defroster and heater to know that they are in OFF position.
   5. Check instrument lights, headlight and cab ceiling lights to know that they are in OFF position.
   6. SET up HAND BRAKE.

3. Q. How is compressor driven?

   A. By an electric motor, belt driven.

4. Q. What are the principal causes for air compressor failures?

   A. No oil in compressor crankcase. Belts slipping due to not having enough tension or in very cold weather an accumulation of ice or snow on compressor drive pulley, defective air compressor or motor.

5. Q. What electrical defects would cause air compressor to fail with one or both engines running?
   A. 1. 20 AMP or 60 AMP fuse loose or blown.
      2. Reverse current interlock not making contact.
      3. Compressor motor defective or defective wiring.

6. Q. From what three sources may an emergency brake application be affected manually?
   A. 1. By placing the M-23 brake valve in emergency position.
      2. By releasing pressure from safety control pedal.
      3. By opening conductor's valve.

7. Q. Once an emergency application of brakes is initiated, can it be prevented?
   A. No. Because the quick action chamber of the D-22-AR control valve must be entirely exhausted of air.

8. Q. When is automatic sanding obtained?
   A. Automatic sanding occurs for approximately 6 seconds following a wheel slip and for 30 seconds after an emergency brake application has been initiated.

9. Q. What precautions must be taken when rails are sanded?
   A. Not to let the car stand on sanded rails. Car must be rolled off the sand to insure signal shunting.

10. Q. What action must be taken to restore brakes to service after an emergency application?
    A. 1. Bring throttle to "OFF" position.
       2. Clear cause of emergency application.
       3. Depress safety control pedal and set M-23 brake valve in lap position 10 to 15 seconds.

          NOTE: Ten to fifteen seconds interval is required to completely exhause the air from the quick action chamber.

       4. Move M-23 brake valve handle to "RELEASE" position until brake pipe pressure equals 60 pounds (full service).

5. Lap M-23 brake valve. In this position the emergency application will be released and service braking restored.

11. Q. With what type of foundation brake are rail diesel cars equipped?

A. With Budd Railway Disc Brake.

12. Q. How does this brake differ from the conventional type of air brake?

A. The disc brake consists of (per axle unit):

(a) Two brake discs securely attached one to each wheel.

(b) Brake assembly. This consists of the "C" frame which supports the shoes, brake heads, tongs, and cylinders in their proper relation to the brake discs.

(c) Hanger box assembly attached to the truck transom member.

The brake assembly is on a three point support which permits free movement of the wheel units.

13. Q. What happens when air under pressure is admitted to the brake cylinders?

A. It forces the brake cylinder piston outwardly, spreading the tongs which pivot about the fulcrum pins and squeezes the brake shoes against both sides of the disc. The friction thus developed between the composition shoe lining and the disc stops or slows down the revolving discs and in turn the wheels to which the discs are fastened.

14. Q. Name the essential parts of this air brake system.

A. 2—M-23-SX automatic brake valves with their equalizing reservoirs.
2—Double-Heading cocks.
2—K-1 brake application valves.
2—Type "C" diaphragm foot valves.
2—Type B-3-B emergency (conductor's) valves.
1—N-1-A brake application valve.

1—D-22-AR control valve: 1-B-3 relay valve.
The necessary reservoirs, brake cylinders and fittings and one air compressor.

15. Q. What system of wheel slide control is used on Rail Diesel Cars?

A. The Rolokron System.

16. Q. What is the function of the Rolokron system?

A. (a) First it detects the instant of excessive wheel deceleration.
(b) It immediately reduces brake cylinder pressure (before the wheel has become locked), thereby allowing the wheel to resume normal rotation.
(c) It restores brake cylinder pressure as soon as the wheel resumes normal rotation.

17. Q. What is the time required to complete this cycle?

A. Approximately 2 seconds.

18. Q. What action should be taken (when brake is applied) and Rolokron picks up repeatedly?

A. Reduce brake cylinder pressure by using graduated release (placing automatic brake valve handle in release position and returning same quickly back to lap). Apply sand then restore brake cylinder pressure by successive reductions until speed of car has reduced sufficiently or stopped, whichever is desired.
NOTE: When making station stops with poor rail conditions, braking should commence a sufficient distance from point where stop is to be made so that unduly high brake cylinder pressure will not be required.

19. Q. How should manual sanding button be manipulated when required?

A. Sanding button must be pressed and held during the sanding period required. Depressing and releasing the sander button in quick succession only momentarily energizes the electrical circuit and causes "CLEAN OUT" feature to function with no useful sand delivery at the rail.

20. Q. What action would you take if the conductor's safety brake valve was open and could not be shut off?

A. Insert pipe plug provided in the threaded hole and stop the blow of air from E-3 application valve under car. The plug is in a dummy bracket on the vestibule door post, over hand brake, "B" side (Painted Red). Report same upon the completion of trip.

21. Q. What position should cut-out cock be in between conductor's valve and branch pipe to automatic brake valve?

A. Open on operating end, and closed on non-operating end.

THIRD SERIES — RAIL DIESEL CARS
MECHANICAL

1. Q. What action takes place when moving reverser into forward or reverse position?

A. Proper gear train is set up within the transmission to obtain movement in desired direction.

2. Q. What action takes place when moving throttle to #1 position?

A. This engages the transmission clutch on each engine thus applying torque or power to the drive shaft between the transmission and axle gear box.

3. Q. If the car does not have the proper acceleration when the throttle is moved to #4 position, what does it indicate?

A. It indicates that only one engine is propelling the car or electrical defects.

4. Q. How should the test be made to determine if only one engine is pulling?

A. 1. Set up hand brake. Apply air brake and make sure that gauge registers 35 pounds brake cylinder pressure.

2. Isolate one engine at a time and load test the engine that is on the line by placing the reverser in forward, move the throttle to No. 1 position and allow clutch to engage, then advance the throttle one notch at a time to check loading in each throttle position. To check the other engine reverse the procedure. Do not keep in #4 position more than 30 seconds.

5. Q. Can this test be made for the opposite direction from the same operation station?
   A. Yes, by moving the reverser from forward to reverse and proceed as in Question 4, Part 2.

6. Q. If generator pilot light is not lit, what does it indicate?
   A. That the generator is not charging.

7. Q. What action should be taken if generator pilot light is not lit?
   A. 1. Check whether the lamp is burned out by observing the pilot light on opposite end of the car.
      2. If lights on both ends of the car are not lit, check generator main fuse and field fuse. If fuse is OK, check reverse current relay, which should be in closed position. Be sure engine is running.

8. Q. What may cause low oil pressure in torque drive?
   A. Low oil supply, oil pump difficulties, air leak in suction line side of inlet pump, sticking regulator valve.

9. Q. What will cause engine to stop at high speed?
   A. Inadequate oil supply, high drive oil temperature, high engine cooling temperature, low oil pressure, leak in oil intake pipe, defective oil pump

10. Q. If cooling water temperature exceeds protection switch setting (200°F.) what should be done to reduce the water temperature?
    A. Hold the reset lever down or leave RUN button out (Neutral button in) until engine pump operation and

cooling fan operation reduces the water temperature. CAUTION: DO NOT OPERATE HOT ENGINE —Do not hold reset lever down or leave Neutral button in longer than one minute.

11. Q. When engine is shut down due to loss of oil pressure, causing air shutdown valve to trip (closed) what must be done to start engine?
    A. Reset lever must be held down or run button out until pressure exceeds 12 p.s.i.

12. Q. What are the reasons for high cooling water temperature?
    A. Low cooling water supply.
    Fan fuses blown, replace blown fuses and be sure that fuses are tight in clips.
    Defective or stuck BY-PASS valve.
    Defective magnet valve which supplies air to by-pass valve.

13. Q. Why is it important to pause several minutes after engine has been cranked continuously for 20 seconds?
    A. To allow cranking motor to cool off. Failing to do so may result in failure of cranking motor.

14. Q. What should be done if engine "RUN" button is pressed in and engine is running but stalls when throttle is moved to #1 position?
    A. Start engine, then place isolation switch located in regulator locker into "ISOLATE" position. At engine control panel press "RUN BUTTON" to keep engine idling, which also cuts in all engine protective devices, and in cold weather, when car heating is required, the engine will supply heat to the car body.

15. Q. What means are provided for shutting engine down?
    A. 1. AT ENGINE CONTROL PANEL by pressing STOP button until engine shuts down and oil pres-

sure switch automatic air shutdown to "SAFE" position.

2. AT REGULATOR LOCKER by ISOLATION switch, hand brake end. To stop engine #1 move ISOLATION SWITCH to "ISOLATE" position, then to "STOP" position. Hold in stop position until generator pilot light goes out, which will indicate that the #1 engine has stopped. After engine has stopped move switch back to "NORMAL."
3. The #2 engine may be stopped in a similar manner by the ISOLATION switch in regulator locker at the non-operating end of the car, watching the pilot light for the #2 engine.

16. Q. What provisions are made for EMERGENCY SHUTDOWN of engine?

A. Press EMERGENCY SHUT DOWN button in regulator locker and hold down until engine stops rotating and GREEN generator light goes out.

17. Q. In case of fire, what provisions are provided to shut off the emergency fuel cut off valve at the tank?

A. Pulling the "RED" fuel emergency cut off ring located opposite the safety control pedal at each end of the car and either side of the car.

WARNING: This method of shut down can ruin the injectors and must not be used except in EMERGENCY.

THIRD SERIES

RAIL DIESEL CARS—AIR BRAKE

The Relative Values of Answers in Per Cent

Question	Value	Question	Value	Question	Value
1	5	9	3	17	1
2	3	10	3	18	2
3	2	11	3	19	2
4	3	12	2	20	2
5	3	13	2	21	2
6	5	14	2		
7	5	15	2	TOTAL	57
8	3	16	2		

THIRD SERIES

RAIL DIESEL CARS—MECHANICAL

The Relative Values of Answers in Per Cent

Question	Value	Question	Value	Question	Value
1	2	7	2	13	3
2	2	8	2	14	3
3	3	9	3	15	3
4	3	10	2	16	2
5	3	11	2	17	2
6	3	12	3		
				TOTAL	43

THIRD SERIES—AIR BRAKE—TROUBLE SHOOTING FOR INFORMATION

1. Q. What action must be taken in case of broken main reservoir discharge pipe?
   A. If leading unit, close main reservoir equalizing pipe between units and pull jumper cable. Operate controls from rear unit. If rear unit is "B" unit, cut in hostler's controls and brake pipe feed valve, you have locomotive brakes on both units, train brakes with conductor emergency valve only.

2. Q. What action should be taken if brake cylinder pipe breaks between cut-out cock and brake cylinder?
   A. Close brake cylinder cut-out cock. This will prevent loss of main reservoir air when locomotive is standing with throttle in idle and independent brake valve in applied position.

3. Q. What action must be taken when air compressor or main reservoir safety valve is missing or broken?
   A. Plug opening. If 1" plug is required it may be obtained from forestalling box or train stop receiver. When 1¼" plug is necessary use brake pipe hose and dummy coupling, if no other means are available.

4. Q. What action must be taken if brake pipe is broken on lead unit?
   A. Close double-heading cock and truck brake cylinders cut-out cocks and brake pipe train line between units. Operate controls from trailing unit: (If B unit) operate in accordance with answer above.

5. Q. What action must be taken if brake pipe is broken on trailing unit, if equipped for passenger service?
   A. Cross the brake pipe and signal hose at both ends of unit affected, cut out brake cylinders on unit affected.

6. Q. On road switch units with No. 6 equipment, how is K.M. vent valve tested?
   A. After equipment is charged to standard pressure with brake valve handle in running position, place auto-

matic brake valve in release position for one minute, then make continuous brake pipe reduction with brake valve in service position until brake pipe pressure is reduced to 50 lbs. If brakes go into emergency, cut out vent valve by loosening up cap screw and turning blanking plate so that lower opening is blanked out.

7. Q. What action must be taken if equalizing reservoir pipe is broken or leaking?

A. In passenger or freight service it will be necessary to close double-heading cock and move the automatic brake valve handle to service position. Open double-heading cock slowly until sufficient brake pipe reduction seems to have been made, then close double-heading cock. If necessary to make additional brake pipe reduction, repeat as outlined.

NOTE: PASSENGER — To release brake, move brake valve handle to running position then open double-heading cock.

FREIGHT SERVICE — It will be necessary to stop before releasing brakes.

THIRD SERIES

FEDERAL OR STATE REGULATIONS FOR SAFETY APPLIANCES

1. Q. What is the intent of monthly and annual inspection cards placed in cab?
   A. To indicate period of inspection and test required by law and the rules of Interstate Commerce Commission.
2. Q. What constitutes a safety appliance as applied to a locomotive?
   A. Such parts as are especially constructed and applied with a view of protecting against personal injury to employee.
3. Q. Name some of the safety appliances on a locomotive?
   A. Air brakes, electric headlight, steps, ladders, handholds, hand rails, and coupler operating levers, etc.
4. Q. How must safety appliances be maintained?
   A. As required by Federal and State Regulations.
5. Q. If any of the safety appliances are damaged or in unsafe condition what must be done?
   A. Warn all persons who are likely to use them of the unsafe condition and report condition at once so locomotive can be relieved or repairs made before locomotive goes into service.

THIRD SERIES

FEDERAL RULES

The Relative Values of Answers in Per Cent

Question	Value	Question	Value	Question	Value
1	20	3	20	5	20
2	20	4	20		
				TOTAL	100

MEMORANDUM